Food Information Systems

February 1976

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FOOD INFORMATION SYSTEMS

HEARINGS

BEFORE THE

TECHNOLOGY ASSESSMENT BOARD

OF THE

OFFICE OF TECHNOLOGY ASSESSMENT

CONGRESS OF THE UNITED STATES

NINETY-FOURTH CONGRESS

FIRST AND SECOND SESSIONS

SEPTEMBER 24, 25, AND DECEMBER 10, 1975, FEBRUARY 4, 1976

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WEDNESDAY, SEPTEMBER 24, 1975

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CONGRESS OF THE UNitedD STATES,
TECHNOLOGY ASSESSME nt BOARD,
OFFICE OF TECHNOLOGY ASSESSMENT,
washington D.C.

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The Technology Assessment Board met at 2 :55 .m., -pursuant to notice, in room 324, Old Senate Office Building, % on. Hubert H. Humphrey (member, Technology Assessment Board) presiding.

Present: Senator Humphre and Senator Kennedy.

Staff present: Mr. EmdioJ . Daddario, director; Mr. Daniel V. De Simone, deputy director; Mr. ,J. B. Cordaro, food program manager; Dr. Walter W. Wilcox, consultant; Ms. Ellen Terpstra, research associate; Ms. Ann Woodbridge, administrative assistant.

STATEMENT OF HON. HUBERT H. HUMPHREY, A U.S. SEMATOR FROM THE STATE OF MINMESOTA

Chairman HUMPHREY. G"ood afternoon. 1 vvould like to welcome everyone to the first day of hearings on food information systems. We have three witnesses with us today-Assistant Secretary of A@culture for International Affairs and commodity Programs, Richard E. Bell, Dale Hathaway, Directoq, International Food Policy Research Institute, and Howard W. Hjort, ,John schmittker Associates—who will begin the Office of Technolo~ Acsssrnent% hearings on the accuracy and timeliness of world and IJ.S. food, agriculture, and nutrition information systems. Through this hearing process, we will additionally hear comments on the OTA Food Advisory Committee)s repoti, entit]ed "Food, Agriculture, and Nutrition Information SyStems: Assessment and Recommendation." [1]

It is a privilege for me to chair the first hearings the Office of Technology Assessment has held on a specific assessment area.

In early 1974 I requested, with the endorsement of the ch'airman of the Senate &riculture and Forestry Committee, Senator Herman Talmadge, that OTA make an assessment of agriculture and information systems and their adequacy for policy planning. The numexwus events that occurred in 19'72 and 19'73 to trigger the necessity for this assessment have been well chronicled. Althou@ these events may be elated, their consequences and effects am still being felt today.

There has been increased attention given to the importance of agricultural information in recent years. In 1972 Senator Bellmen and I visited the Soviet Union, and our report, "Observations on Soviet and

[1] See p.4

Polish Agriculture," offered a number of recommendations such as increasing the number of agricultural attach& assigned to the Soviet Union.

The World Food Conference of November 1974 was intimately concerned with this issue, and I wrote to Ambassador Edwin Martin urging our delegation to support the establishment of a World *Food* and Agricultural Information Center.

These hearings come at a most opportune time. The recent Russian grain purchases, their impact cm food prices, and their disruption of our agriculture marketing processes have again underscored how fragile our information systems are to deal with unexpected events. Many have asked:

> Why did the U.S. food and agriculture information systems fail during the 1972-'73 period? What are the defects in our system ?
>
> In view of this and subsequent developments, do existing food and agricultural information systems meet today's needs? What improvements should be made to correct the deficiencies in the system ?

A report submitted to the Office of Technology Assessment by OTA'S Food Advisory Committee detailed several options for the Congress to consider. These hearings follow through on the options in the committee's report. The committee, a distinguished roup of academicians, scientists, and industry and media leaders, wiY1 participate in hearings scheduled for February 4, 1976.

Because Congress is intrinsically dependent upon outside sources for information upon which it bases decisions, it is necassary to focus on these sources, especially the U.S. Department of Agriculture. These hearings will underscore the importance of this subject area, explore ways in which the options identified by the Food Advisory Committe~ might be implemented, and clarify them.

The importance of the% hearings grows out of the recent depletion of world food reserves. As long as apparently limitless reserves were available, there seemed little need to gather exact information on the world food situation. Emergencies could always be met. .

That is no longer the case. Only through adequate planning and careful coordination of national food policies in the light of systematic ~ and timely information on the current food situation can the world overcxune the present crisis.

We must diminish the realm of the unpredictable. We must take some of the guesswork out of agricultural policymaking. Only in this . . way can we provide a sound basis for world food policy.

Systematic information on the world food situation is particularly important for the United States, the world's major food exporter, because of its open, free market system.

In view of recent and prospective Soviet grain purchases in U.S. markets and the great uncertainties that have been created for U.S. producers and consumers, I decided that the first 2 days of hearings be devoted to an evaluation of the accuracy and timelmess of information on U.S. and world agricultule in 1975.

It was the Soviet grain purchases in 1972, and the chaos in U.S. grain markets which resulted from these purchases, which led me to request an assessment of our food and agricultural information systems for food policy planning.

I am pleased that President Ford has taken the initiative in negotiati a long-term grain purchase agreement with the soviets. 1n theseT earings 1 plan to probe the information demands that a sound agreement must address. If we are to depend primarily on the free n]arket system, 1 believe our producers should learn of the soviet intentions to buy specific quantities of grains in united states and world markets at the same time that private traders are informed, rather than weeks later. I hope to learn that the Soviets have agreed to space their purchases throughout the marketing year> rather than creating meat market uncertainties by making large annual purchases during the harvest season before the full domestic and export requirements for the marketing year are known.

These hearings substantially implement option No. 6 of the Food Advisory Committee's report., which states:

> We recommend that the Agricultural Committees of the Congress schedule hearings to determine what improvements in the Foreign Agricultural Service and the Economic Research Service have been made since 197!2-73, and what further improvements are feasible.

I note that there has been a substantial increase in the number of reports issued by both the Foreign Agricultural and the Economic Research Services. It no longer is possible to separate the domestic from the world food situation. Yet my contacts with staff and constituents who depend on the Department of Agriculture for current information question the continued lack of integration of the staff which gather and analyze the world and the domestic information. They question whether this administration is placing as high a priority on economic intelligence as current conditions warrant.

Our first witness will be Assistant Secretary Richard Bell, who will bring us up to date on the improvements in our information on a~i-cultural production and food import requirements of the Soviet Union resulting from the information exchange agreement entered into with the U.S.S.R. in June 1!)73. We find our U.S. grain markets in the summer of 1975 disrupted again, much as they were in 19'72, by rumors as to the Soviets' buying plans.

I hope filr. Bell will be able to report on the progress of the U.S. effort to negotiate a long-term grain sales a~eement with the U.S.S.R. I hope it meludes a provision which rcqmres that prior to entaring negotiations with private grain exporters, U.S. informational agencies will be informed as to the amount of the planned purchs.

It is my hope that as a result of these hearings, the people will learn how much of the confusion regarding Soviet food recpnrements that occurred these past few weeks can be avoided in the future.

After reviewing the current situation with respect to information available on food and agriculture in the Soviet Umon and the People% Republic of China, we will look into the improvements in the informational activities of the international agencies in response to the resolutions of the 1974 World l?ood Conference.

Tomorrow afternoon we will have a panel from the Department of Agriculture review the Department's world information gathering and analytical capabilities, followed by several witnesses from the private grain trade and industry who wdl report on their experiences m to the accuracy and timeliness of the information needed by their firms in con(~uet ing their business operations.

Information is a precious commodity. To be useful, it must be objective, timely, and reliable. Such information will not automatically ensure better decisions, but it will expose those decisionmakers who fail to use these resources.

[The following material was referred to on p. I]

FOOD, AGRICULTURE, AND NUTR.ITIO~ INFORMATION Systems: ASSESSMENT AND REMMMENDATIONS

(Report of the Food Advisory Committee, Congress of the United States, Office of Technokqgg Assessment)

Food Aiihhory Committee

Dr. Clifton R. Wharton, Jr., president of Michigan State University is the committee chairman.

Dr. .Mm-tin 11. Abel, University of Minnesota.

Dr. W. D. Buddemeier, director of international agriculture pro-~l~::i~and associate dean, College of Agriculture, University of

Dr. "David 4X1, director of cooperative extension, Cornell Univemity.

Dr. D. @le Johnson, vice president and dean of faculties, University of Chicago.

Arnold Mayer, legislative representative., Amalgamated Meat Cutters & Butober Workmen of North America.

Dr. Chester O. McOorkle, executive vice president, University of California (committee member through May 19'75).

Dr. Max IMilner, Department of Nutrition and Food Science, Massachuetks 1n~itute of Technology.

Dr. Robert Nesheim, vice president, research and devdopment, @~aker Oats co.

Esther Peterson, president, Nyational Consumer League, and consumer advisor to the resident, Giant Food, Inc.

Prof. Roger Revelle, director, Center for Population Studies, Harvard University.

Leon Schachtir, international vice president, Amalgamated Meat Cut'tmw & Butcher Workmen of North America (commitie member through May 1975).

Txumen Seth, editor of the editorial page, Des Moines Register and Tribune.

Dr. E. T. York, Jr., provost of the University of Florida.

Preface

The growin~ world interdependency has highlighted the information systems describing that interdependency, Nowhere is this need clearer than in the mwas of food, Wriculture, and nutrition.

The U.S. Congress recognized the centrality of this problem for some ~ime. But @he events of reeent years led them to make this area the fiti ptiority for the attention of the newly organized Food Advisory ("ommittee of the Office of Technology Assessment.

As work in this area began, the committee realized that information systems, even when limited to food, agriculture, land nutrition, is a broad topic. The current information system was never designed as a total system but represents an historical accretion based upon multiple uses and purposes---often conflicting. While the committee recognized the ideal would be to address the needed improvements in the total system, we realistically concluded that an adequate assessment of the total information systems would have retumed greater resources and more time than was available. The committee therefore chase to concentrate its attention *on* a limited set of recommendations. Two criteria were employed: Those areas which are most amenable to congressionnl action and those which in the committee's judgement most urgently require attention.

Our focus was also limited to the information systems rather than the analysis of the information gencrated by the systems, even though past problems often have been more clue to poor analysis than deficient information.

Tho twelve major recommendations are devoted to the need for: greater analytical capability, correction in data obsolescence, improved timeliness and reliability, better fertilizer information, strengthening the economic Research service. Statistical Reporting service and the I'oreian Agriculture Service, utilization of new information gathering technolo~~', improvement in nutrition information systems, and improvements in the international food and agriculture information systems.

The work of the Food Advisory Committee was considerably *aided by* the detailecl studies of three contractors: Michigan State University: Sidney M. Cantor Associates, Inc.; and The Futures Group, Inc.

While these reports were not a formal part of the committee% report, the person seeking greater depth and breadth of coverage will find them highly rewarding.

Various members of the OTA staff were most helpful to the committa in preparing base documents, summary statements and preliminary drafts. In this process we would especially single out Mr. ,T. ~. Cordaro and Dr. Walter Wilcox. Responsibility for the final document is,"of course, the committee's alone.

We sincerdy hope that our recommendations will prove valuable to the Congress and worthy of serious consideration.

Crmrro~ R. WIIAR~N, Jr.,
Chairman, Food Advisory Committee

JUNE 19'75.

Introduction and Sumnwy of Reco9n7nendation9

Within 2 months in mid-1972 the world food situation changed suddenly. This was due chiefly to poor crop conditions over much of ~~sia and large purchases of U.S. wheat by the Union of Soviet ScP cialist Republics. The phenomenal and unexpected increases in prices of wheat, feedgrains, and soybeans after October 1972 disrupted the U.S. livestock economy and within a few months retail food prices were rising rapidly. These developments tuok place in con-junction with a less visible, longer run reduction in stock due to the rapid growth in per capita income in a large number of developing and developed countries.

As world grain production dropped sharplyin 1972-73 and world demand surged upward, world food stocks were reduced to historically low levels In some of the developing countries, there was less bread and rice for poor people. In some developed countries, there was less grain and protein feed for livestock, and consumers experienced smaller supplies of meat and sharply higher retail food prices. The increases in retail prices of U.S. farm products and food from October 1972 to August 1973, were by far the largest experienced since 1945-48.

The magnitude of the increase in farm product and food prices in the United States was not publicly predicted by authoritative sources inside or outside government. Members of Congress were concerned about the sharp increases in the cost of food and farm inputs and by shortages of production supplies, especially fuel, protein meals, and fertilizers. Why had the U.S. food and agriculture information systems failed to warn them of the impendmg shortages?

Underlying the dramatic events of the 1972–73 period have been recent fundamental changes in the world food situation. These include continued rapid increase in world population, the rise in consumer consumption expectations including increased demands for livestock products, sharply increased international trade in food, an increased dependence of the U.S.S.R. and the People's Republic of China on world grain markets, wide shifts in monetary exchange relationships, widespread inflation> and now widespread economic recession.

In view of these developments, are current food and agriculture information systems adequate ?

Do the food and naviculture information systems, with their emphasis on food production and disappearance, which yield only fragrnentary information on nutritional status of specific groups, prmude adequate information about the nutritional status and food habits of all consumers ?

How well do these current information systems meet today's needs?

This report is an assessment of the food, agriculture, and nutrition information systems which now serve Congress, executive departments and agencies, State and local governments, researchers, and private citizens. It focuses primarily on information concerning national and world food production, trade, stocks, prices, and disappearance, and on information needed for policy decisions made by Congress, Federal agencies, State governments, and a~ibusiness.

The existing agricultural information system, for the most part, measures output and its various ramifications. It is basically an impersonal, production oriented system. What happens to food after it reaves the final point of sale is not included in this system. A food and nutrition information system should also be a consumer oriented system that builds upon the nutritional needs of the consumer. It should relate food to the nutritional needs of the individual.

International and national nutrition information systems are considered primarily from the viewpoint of their adequacy for providing policy guidance to Congress in the areas of food and nutrition. There 1s no attempt to assess the many subsectors of the food, agriculture and nutrition information systems, each of which may be important to other clientele.

Summary Recommendations

MORE ANALYTICAL CAPABILITY NEEDED

More complete and more reliable information is needed on world agriculture; the recognized need for an effective food and nutrition surveillance system has not been met. Con gress greatest need, however, is for more analytical services and ca%ility for dealing with the burgeoning information flow on the rapidly changing food, agricultural and nutrition situation.

* 1. *We recommend that the Congress increase the analytical capability of the staffs of its agricndtural committee.~, and of the agricultural specialists in the Congressional Research Service A group of several compertent analysts of making its studies should be available to Congress.*

5 Congressional committees and subcommittees now call on the USD.4 Economic Research Service and land grant universities for analytical reports on issues of concern to them. A part of the increased analytical ca]x~bilities needed by ~longrcss could be provided by a closer worl~-ing relationship with executive agencies and other institutions, in-c~nding in some cases, additional financing for specific studies.

Z ?~re *aho recommend that the Congress develop clo8er i&~i80n with the exeeut?'ve agencie8 and the ~and grant wniver8u%e8 requesting thcm to devote more of tllez'r analytical capabiWe8 to the analy8i8 of $;)f ommztion f or Congress.*

Obsolescensce in data correciton

Wc find serious obsolescence in many food and fiber data series. In addition, many new dccisionmnking demands arc being imposed on data systems which were not designed for such purposes. Although a distin~lishecl committee of the American Agricultural Economics .~~s ocln ti on urged action i n ~i ea ling with these issues as long ago as I!)7z., efforts on the part of responsible administrators lool<in~ toward the Improvement of these data series has been frustrated by laclc of public concern and support.

,3. *We recommend that eifher the Joint I?conQrn,ic Committee? or one or both of the Agrz"cwltwe Committees, rejnwt the Secretary of Agri-mdtwe to establish cm. ogricwdturul statistical review com?m'ttce charged with responsibility of making recommendatibna to the Con-~rem and appropriate executive agencies for zwodernizin~, coord~~af -kng and ~tandardizi~ the food and fiber data aert"ea. Thi8 agricuh.wa~ 8tati.~ti$a.l rem%w committee 8hcwld include member8 from the van"ou8 discipline~ and groups who utilize food and agricultural data.*

IMPROVEMEN"I' 1> TIMELIN"ESS .4ND RELIABILITY OF DATA NEEDED

llfost national food and agricultural data series arc released promptly. There was, however, an excessive time lapse before the last agricultural census data were available.

The timely collection and release of reliable agricultural data by the Census Bureau has encountered serious problems in recent years. In order to reduce costs, the Census Bureau is conducting the agricultural census in 19T5 with primary reliance on the return of mailed quest ionnaires.

A private consultant group, American Agribusiness Associates, found that more accurate benchmark data could be provided by the USDA. Statistical Reporting Service at the same or lower cost than by the continuation of the 5-year agricultural censuses conducted by the Census Bureau. Other users of agricultural census data believe that both the reliability and timeliness of such data could be improved if the responsibility for providing such data were transferred to the Statistical Reporting Service.

4. *We recomnnend tltat the congremioruzl c0nwnittee8, which have juridictwn ovor the Depa.rtnumt of Agriculture and the %ureau of Lfen8u8 actiuitie8, study the de8irabiZity and feasibility o integrating the 8tajl' and activitie8 of the Agricultural Uensm into tL* ***~tdi8tihd*** *~eporting Service. #uc?b a study, with hearin* **8** *if needed, 8hou2d be 8chcdu~ed w~thin the rwxt calendar year. If tL re8dt8 8U~#WTt 8uch a .trazwfer, a Propriatc @@$ation 8hould be t?nwtea? providing for tran8fer of tl e re8ponMdzty for agtiltura7 benchmark data to tb il!ltati~tical Reportinq Service when the procemhtg of the J9Y5 agricultural cen8us data ;s completed.*

IMPROVEMET' IN' FERTILIZER INFORMATION SYSTEM NEEDED

The collection of fertilizer information and its anal sis and dissemination are shared by ten governmental agencies anl!'at least two industry-financed trade associations. There is substantial consensus among the users of this 'information that important improvements are possible, especially in terms of the timeliness of t e reports, increased reliabdity, and the publication of the scattered information in comprehensive monthly and annual reports.

,5. We *recommend that the 8everal congressional committee,~ having responsibility for the executive agencies which correct and public the various series of data dating to fertilizer conduct studies and hearings to determine ways, means, and costs of improving fertilizer information systems.*

STREXGTHENING OF TIIX? ECONOMIC RESEARCH AND FOREIGN AGRICULTURAL SERVICES NEEDED

In fiscal year 1972-73, when the failure in the international food information system occurred, the Government was spending $61 million annually on the four basic national agricultural information agencies: the Statistical Reporting Service, the Economic Research Service, the Market News Service, and the Foreign Agricultural Service.

Since early 1972, the Economic Research Service has been reorganized, and minor reorganizations occurred in the other agencies. Additional funds were requested by the agencies to permit them to collect additional data and to provide for more analyses.

In part, as a result of these actions, appropriated funds for these four agencies were increased to $73 million in 1974-75 and appropriations of $80 million are being requested for the 1975-'76 fiscal year. In terms of purchasing power, however, the $80 million requested is slightly less than them agencies received in 1972-73.

Important steps have been taken since 1972 to improve the quality and timeliness of the information available on world agriculture and agricultural requisites. We believe, how-ever, that additional improvements are needed.

The Foreign Agriculture Service should improve its information collection capability by: Giving its attach& basic training in information gathering expanding its reporting capabilities in the critical developing countries; improving Its data transmission and the timeliness of its summaries; improving its reports for the major commodities, talking into account probable requirements of the importing countries; and improving its reports on world agricultural requisite supplies and requirements, especially fertilizer.

The economic research Service should improve its world information analysis capability by: Strengthening its ability to analyze, evaluate, and interpret current world information on a monthly basis during the crop growing and early harvest season; increasing its abilitv to analyze current world weather data and interpret its significance, in terms of probable crop production in the current season; and developing world models of production, utilization, trade, and prices for the more important agricultural commodities, especially grains, which would permit timely evaluation of new data on a monthly basis du ri ng the growing and early harvest season.

6'. *We recommend that the Aqriculture Committees of the Congress schedule hearings to detcmine what improvements in the Foreign, Ayriculturol Service and Economic Research Service have been made since 1972-73, and what further improvements are feasible.*

Such hearings should focus on: Additional data series to be collected by the Foreign Agricultural Service; steps to increase the timeliness of reports issued; steps to improve the quality of the data obtained from abroad; and appraisals by the administrators of these sin-ices concerning additional improvements that could be made in existing information systmxs, and the probable cost of achieving the improvements.

DEVELOI'MENT OF IMPROVEMENT TECHNOLOGY

We, note with approval that the Department of Agriculture has joined with the National Aeronautics and Space Administration and the National Oceanic and Atmospheric Administration to detemine whether data gathered by satellite and analyzed with the aid of computers can improve the timeliness and accuracy of major crop fore casts. We also note with approval that the National Oceanic and Atmospheric Administration is cooperating with the Statistical Reporting Service in the analysis of weather data as related to crop yields.

7. We believe ~t is *urgent that experimwtf9 mid analy8ef9 utilizing nwo tc~hnologi~s for obtaining and andy.zin,q data go forward o~I on e,rpm~dinq SWJC as preliminary rcswlt~~y inc7wling cost efectirtw~ss or)a7ytw.s7 justify.*

NCTRITION IXFOR3f.iTION SYSTEMS N? RIOUSI,Y DEFI('IEhT

~~e find that although the I?ederal Government appropriated $6.1 billion for food stamp and related food distribution pro~rams in tlm 1975 fiscal year, it has not conducted adequate, objective pro~~am evaluation studies to determine the extent to which these programs are achieving the goals set for them by Congress.

8. *We recommend that Congress request the Food and Nutrition* Service which *administerd the food assistance programs to expand substantially its program evaluation studies. These studies should be integrated to maximize their cost effectiveness and ensure getting the quality and type of information necessary to make appropriate evaluations.*

Meaningful food and nutritional surveillance information is far more difficult and costly to obtain than comparable information on food production. This is because of the difficulty of measuring food consumption and nutritional deficiencies. In part the cost is related to survey methods which require clinical evaluations as a part of a comprehensive evaluation of an individual's nutritional status. Nutritional scientists also are not fully agreed on the significance and reliability of specific tests for nutritional deficiencies. Even though the White House Conference on Food, Nutrition and Health in December 1969, emphasized the need for a national nutritional status monitoring or surveillance program, little progress has been made in establishing such a program. The Senate Select Committee on Nutrition and Human Needs has held many hearings and issued many reports since that time but, thus fax, has made little progress in developing a national nutritional status surveillance program.

9. *We recommend,* as *a* first step *developing a* national nutritional *status monitoring ,and surveillance program, that the Select Committee hold hearings on the adequacy of design and integration of the onqoing nutrition suweys being conducted by Department of Health, Education, and Welfare, and the planned Household Food Consumption Survey to be conducted by the Department of AgriouZture.*

The Food Advisory. Committee plans to consult further with leading nutritional Scientists, and make recommendations for establishing a continuing nutritional status surveillance program.

IMPROVEMENTS INTERNATIONAL FOOD AND AGRICULTURE INFORMATION SYSTEMS MERIT SUPPORT

Resolution XVI of the *19~4* World Food Conference recommends a greatly expanded global lnformat:on and *early* warning system on food and agriculture..FAO is now m the process of improving and expanding its information collection and dissemination activities as directed by the resolution. It will be limited in its expansion plans both bv funds and by a shortage of technically competent staff.

10. We recommend *that the United States strengthen* its **own** *agricultural information agencies, but, in addition, the United States can and should provide increased financial and technical assistance for FAO information activities*

It could perhaps help guide development of FAO information activities by making financial grants and/or loaning the technically qualified staff to accomplish specific, agreed-upon tasks in the information field.

At present, the FAO staff, and the staffs of other international agencies which issue information on world food conditions, often are limited by the data supplied by member countries. Sometimes other information indicates that the official reports are out of date or have been politically motivated. This is a serious handicap for international information agencies.

11. We recommend that Congress request the United States representatives with supervisory and liaison responsibilities for internationail information agencies to support the development of rules and regulations for the international professionul staffs which would authorize and direct these staffs to use the most reliable information available to them when compiling *their reports.*

FAO, in implementing World Food Conference Resolution XVI, concerning the improvement of basic data, reports that it plans to provide more technical assistance to individual countries for improving the methods of reporting on current harvests and crop conditions. This is an area where the United States has made important contributions in the past through technical assistance activities of the Agency for International Development. Congress in its authorization for AID has given a high priority to food and agriculture.

12. 'We recommend that Congress direct AID to increase its technical assistance for the improvement of agricultural infmvnatiun systems, including the introduction of advanced information technology, in the developing cowntries most deficient in their agricultural statistical institutions.

ADDITIONAL NUTRITION STUDIES PLANNED

The implementation of these 12 recommendations would result in eliminating the major existing gaps in the world food and agricultural data series and make substantial improvements in the national series.

If implemented, these recommendations also would greatly increase the range of analyses of current information available to Members of Congress. The need for an improved food, agricultural and nutritional information system growing out of the growing world interdependency would be substantially met. The danger of some future failure of the system similar to the 1972–73 occurrence would be lessened.

The assessment of the nutritional information system indicates that little if any progress has been made toward establishing a national nutritional status surveillance program. The need for such an informational program was outlined by the 1969 White House Conference on Food, Nutrition, and Health. The need for such a program was reemphasized in hearings held by the Senate Select Committee on Nutrition and Human Needs in June 1974 and detailed in their May, 1975 report entitled '(Towards A National Nutrition Policy."

Many complex issues are involved in established a cost-effective surveillance program. The Food Advisory Committee plans to continue its assessment in this area, consulting further with leading nutritional scientists and make specific recommendations in the near future. A subcommittee has been appointed for this purpose.

Food, Agricultural, and Nutritional Informtion Needs of Congress

This section explores the food, agricultural, and nutritional information needs of Members of Congress as a prelude to assessing the deficiencies and suggesting changes.

CONGRESSIONAL WORKLOAD

The Senate Committee on Agriculture and Forestry in the 93d Congress had 177 bills and resolutions dealing with food, agriculture, and nutrition referred to it for consideration and possible legislative action. The Committee on Agriculture of the House of Representatives in the same period received 565 similar bills and resolutions. Another 1,089 bills and resolutions dealing with food agriculture, or nutrition were introduced by Members of the 93d Congress and referred to other committees having jurisdiction over the particular issues addressed in the 'bills.

The number of bills and resolutions dealing with food, agriculture, and nutrition introduced in the 93d Congress, and referred to each of 13 committees in the Senate and each of 19 committees in the House of Representatives is shown in the accompanying table.

TABLE I.-*Bills and resolutions dealing with food, agriculture, and nutrition introduced in the 2d session of the 93d Congress*[1]

	Number of Wlu and re601uti6na
Referred to Senate Committee on:	
Aeronautical and Space Sciences	
Agriculture and Forestry	177:
Banking, Housing and Urban Affairs	17
Commerce Committee	16
District of Columbia	1
Foreign Relations	
Finance	2:
interior and insular Affairs	5
Judiciary	
Labor and Public Welfare	55
Post Office and Civil Service	4
Public Works	1
Rules Committee	8
Total Senate	330
Referred to **House Committee on:**	
Administration	
Agriculture	**565**
Appropriations	**7**
Armed Services	**1**
Banking and Currency	**116**
District of Columbia	**1**
Education and Public Welfare	**133**
Foreign Affairs	**25**
Government Operations	**1**
Interior and Insular Affairs	**9**
Interstate and Foreign Commerce	**373**
Judiciary	**23**
Merchant Marine and Fisheries	**12**
Post Office and Civil Senile	**10**
Public Works	**1**
Rules	**20**
Sciences and Astronautics	**1**
Veterans	**6**
Ways and Means~	**192**
Total House	**1,501**

[1]**From the House Bill Status Office.**

Each year Congress also must approve appropriation bills authorizing Federal Government expenditures of billions of dollarsfor Federal food assistance, farm income support, research, education, and regulation in fields of food, agriculture, and nutrition. The more important food, agriculture, and nutrition issues in 'the 93d Congress, other than the level of funding of the already authorized Federal programs in these fields, dealt with the desirability and feasibility of:

Additional export restrictions to reserve adequate domestic food supplies for domestic consumers;

Modifying energy price control and allocation regulations to assure adequate energy supplies for the production of fertilizer, crop drying, and related agricultural activities;

Making additional quantities of limited supplies of our food available, through the Food for Peace Public Law 480 program, to developing countries that are unable to purchase their food requiremenents in the commercial markets;

Increased regulation of trading in commodity futures markets to safeguard the rights of the traders and to improve the efficiency of the markets;

Providing emergency credit for livestock producers who are suffering from the squeeze of sharply increased feed costs while livestock and livestock product prices failed to increase or declined;

Modifying the peanut, rice, and tobacco price support and supply adjustment programs, to reduce governmental program costs, and increase their market orientation.;

Amending legislation regulatmg the use of agricultural chemicals and feed additives 'by reducing the scope of specific regulations which sharply increase production costs yet provide only limited benefits to society;

Amending the Agricultural Act of 1973 to give farmers increased economic protection, in view of the sharp increases in production costs and to provide adequate incentives for increased food production;

Explorinnumerous rural development issues through '(oversight" hearings held by both the House and Senate subcommittees on rural development in the 93rd Congress.

In addition to these major food, agricultural, and nutritional issues which were debated in the 93d Congress, there were hundreds of constituent requests for congressional assistance which required Members of Congress and their staffs to acquire up-to-date in information in order to be able to respond to them.

SOURCES OF INFORMATION"

Although a Member of Congress, or his staff, seldom has as much information as he would like to 'have on a particular issue, Congress does not suffer from a dearth of information. Rather, the Members' offices are almost overwhelmed by the volume of reports, letters, news items, and telephone calls coming into their ofice each day.

They depend heavily on the statistical and related reports of the cxecutive department agencies, the news media, constituent mail and reports, lobbyists, and the Congressional Research Service.

The screening of this massive flow of information is an enormous job. The pressures for immediate action within Congress me severe and little time is available for analysis and synthesis of the information streams. This is especially *true for analysis* and planning with

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respect to the longer term problems in the food, agricultural, and nutritional areas. Ideally congressional policy should be backstopped with informational systems which have three equally important components: [1]"Statistical measures which provide an "early alert' system of problem identification; measures to provide adequate description of the problem and allow the formulation of policy options; and reformulation of technical statistics into measures that can be communicated in a form to allow ready interpretation and understanding by busy members of Congress who are not fully familiar with many food, agricultural, and nutritional issues.

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CONGRESSIONAL RESEARCH SERVICE

The Congressional Research Service with its automatic data processing facilities and other research resources is the only agency which has " m its primary goal the organization of information specifically to meet the day-to-day requests of Members of Congress. It maintanns a corps of analysts in most subject matter fields, and news clipping services ready to respond to requests by Members of Congress for information on speoific issues.

In recent years, increasin amounts of information most commonly requested by the Congress have been accumulated in computer data banks available on a moment's notice. Automatic data processing of information for congressional use is in its infancy. Some of the greatest progress in the next few years will be made in this field.

MORE ANALYTICAL CAPABILITY NEEDED

We conclude from this assessment that more reliable information is needed on world agriculture and the nutritional status of the people. Congress greatest need, how~ver, is for more anal tical ca ability for deahngwlththe burgeonm~ ?nform:atlon flow on t e rapid y changing food, agricultural, and nutritional wtuation.

We reconwnend that the Congres8 increaxe the analytical capai%lity of the 8ta#8 of it8 Agm"cultural Conwnittee8, and o the agricwttural 8pem"ali8t8 in the Congre88iuna~ Re8earch ~ervhe. 1 group of 8everaZ competent analy8t8 capabk of making it8 own 8tua?ie8 8how?u? be available to Congre88.

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Congressional committees and subcommittees now call on the USD.~ Economic Research Service and land grant universities for analytical reports on issues of concern to them. Fart of the increased analytical capability needed by Congress could be provided by developing a closer working relationship with executive agencies and other institutions, including, in some cases, additional financing for specific studies.

*We &o recommend that the Congre88 develop do8er Uai80n with the executive agen.&e8 and the land gramt univer8itie8 requesting thenb to devote more of t?wir andyttiaZ capabWtie8 to the anaZy8h **of infor- ?n&on for** congre88.*

[1] Mayer, Leo V., and Abalt L. Dawson, "Public Policy Demands and Statistical Measures of Agriculture," *American Journal of Agricultural Economics*, vol. 66, No. 5, December 1974, pp. 984–988.

National and International Food and Agricultural Information Systems

Each year, the U.S. Department of Agriculture publishes a volume entitled "Agricultural Statistics" containing over 800 statistical tables including new data for the previous year. The introduction to one of these recent volumes states:

> **"Agricultural Statistics" is published each year to meet the diverse needs for a reliable reference book on agricultural production, supplies, consumption, facilities, costs, and returns. * •* Most of the data were prepared or compiled in the U.S. Department of Agriculture. * * * Its tables of annual data cover a wide variety *in* forms suited to most common use.**

STATISTICAL REPORTING SERVICE

In addition to this annual publication, the Statistical Reporting Service of the Department of Agriculture-with a budget of $27 million in 1975—publishes a series of monthly and quarterly reports on crop and livestock production, supplies, and prices. It publishes other reports at specific times once or twice during the year, such as farmers' crop planting intentions published in March.

It is probably best known for its monthly forecasts of crop production as the growing season progresses. These reports are based primarily on careful counts and measurement, at the beginning of each month, of the plants growing in specific sample plots in all parts of the United States, selected on the basis of probability sampling. Each month estimates are made of the probabye crop outturn, taking into account the condition of the crop at that time, and assuming normal weather will prevail for the balance of the crop growing season.

Fifty years ago, estimates of acreages planted of the various crops crop production, and livestock numbers of farms were based on voluntary reports sent in by cooperating farmers, and observations of State and Federal employees who drove through key farming communities. Today they are based primarily on enumerative probability samples from both area and list frames; basically area samples for crops and multiframe sampling procedures for livestock. Precise acreage measurements and livestock counts are taken for the sample areas. In addition to its estimates of crop acreage and production and livestock numbers on farms, the Statistical Reporting Service issues reports on stocks of grains and oilseeds on farms and in warehouses, cold storage stocks of selected products, cattle on feed in fattening lots, broder chicks hatched, milk production, prices received and rices paid by farmers, and other similar reports. For each report, t e Service has developed a system for information, which is as accurate and reliable information as possible for a reasonable expenditure of funds. Resulting national estimates for major crop acreages and livestock inventories have sampling errors of 2 percent or less.

All periodic and annual estimates are subject to revision over a period of approximately 5 years as data from marketing, processing plants, and other sources become available.

ECONOMIC RESEARCH SERVICE

The Economic Research Service of the Department of Agriculture, with a budget of $22 million in 1975, analyzes the data reported by the Statistical Reporting Service, by the Agricultural Census, the Agricultural Marketing Service, the Foreign Agricultural Service, and by other agencies of the Department of Agriculture as well as data from financial institutions and agribusiness. It is best known for its situation, and outlook reports for specific farm commodities such as wheat, feedgrains, livestock, and dairy products, which are issued several times during the year.

In addition to publishing the national situation and outlook reports issued at regular intervals, ERS participates in regional outlook conferences, and the various ‘branches of the Service issue a wide range of analytical reports. Among these are found economic development activities in rural areas, analyses of employment of migratory and other hired farm labor, economic developmental activities in forei=- countries, and summaries of the financial assets of farmers. It has developed a national agricultural production model, which is used in the evaluation of alternative farm program proposals and for a large number of similar analyses.

The agriculture committees and subcommittees of the House and Senate occasionally request the Economic Research Service to prepare special analytical reports, such as the report, “The U.S. Food and Fiber Sector: Energy Use and Outlook,” a Ill-page report prepared for the Subcommittee on Agricultural Credit and Rural Electrification of the Senate Committee on Agriculture and Forestry in September 1974.

AGRICULTURAL MARKETING SERVICE

The Agricultural Marketing Service of the Department of Agriculture is charged with the responsibility of administering a large number of inspection, grading, and other marketing regulations. It is a major source of information on products processed and marketed. Its Market News Service (with a budget of $11 million in 1975) provides daily, monthly, and annual information on market supplies and prices in the principal markets of the United States.

FOREIGN AGRICULTURAL SERVICE

The Foreign Agricultural Service (with a budget of $13 million in 1975 for its information services) collects and disseminates information on world agriculture. In 1974, it had attach& stationed in 63 foreign countries spending approximately 40 percent of their time reporting agricultural information from more than 100 countries. In 1973, these attach& sent in 3,091 reports. The Foreign Agricultural Service also receives over 2,500 foreign agricultural publications annually. Frequent highlight reports covering agriculture generally are received from attaches stationed in the 27 more important developed and developing countries.[2]

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[2] Foreign Agricultural Service, in interview with Walter W. Wilcox, October 1974.

CENSUS BUREAU

Since 1840, the Census Bureau, now located in the Department of Commerce, has taken an agricultural census at least every 10 years and, since 1930, the agricultural census has been taken eve 5 years. At one time, local census takers were employed and trained by the Federal officials and directed to visit all farmers in their districts and obtain accurate reports on the acreage farmed, the acreage owned and rented, and the production of crops and livestock products in the previous year.

However, the 1969 and 19'74 agricultural censuses, which were taken in the early months of 1970 and 1975, were done by means of mailed questionaires sent to lists of farmers and farming corporations obtained from the Internal Revenue Service and other sources.

Three different questionnaires were used: A short one for small and part-time farmers, a more detailed set of questions for medium-sized and larger farmers and an even more extensive questionnaire for farming corporations. For the large farms, followup telephone calls were made if the completed questionnaires were not returned as requested.

In the past, the agricultural census reports have been taken as reliable benchmarks and all annual estimates of crop acreages and livestock numbers have been revised as necessary to conform to them. In recent years, however, incompleteness in coverage by the agricultural census and technological advances by the Statistical Reporting Service have resulted in the SRS providing the more dependable national estimates.

Informtion on materials used in agricultural production is supplied for the most part by the biennial census of manufacturers and by other periodic reports compiled and issued by the Census Bureau. In the case of fertilizer production, utilization, and prices, however, several different agencies participate in supplying the information. The Census Bureau issues monthly reports *on* the production of inorganic fertilizer materials, the Bureau of Mines issues reports on potash, phosphate rock and sulfur production, and the U.S. Tariff Commission issues reports on production of organic fertilizer materials, especially urea. The Statistical Reporting Service collects fertilizer utilization information from State fertilizer regulatory agencies and publishes monthly fertilizer utilization reports. Twice a year, it also collects and publishes 'information on prices paid by farmers for the various fertilizers. Finally, the Bureau of Labor Statistics collects and publishes monthly data on prices paid for fertilizer at wholesale[3] The adverse effect of this fragmentation will be discussed later.

OTHER SOURCES (DOMESTIC)

A continuing flow of *research* information also is provided by the Agricultural Research Service, the land grant universities, and the State agricultural experiment stations. Most of the reports issued by

[3] Wilcox, Walter W., 'assessment of National and International Fertilizer Information Systems," Assessment of Food, Agriculture and Nutrition Information Systems—working papers from Michigan State University, June 1975.

these research bodies are primarily of interest to other researchers or to a limited number of producers who are concerned with the problem researched. They are indexed by the Department of A "culture in a computerized information retrieval s stem called CR S. A Member of Congress ma use this service and quickly learn whether or not there are resea.rc reports on a problem of interest to him.

FOOD AND AGRICULTURAL ORGANIZATION (FAO)

The international food and a agriculture information available to Members of Congress and othe readers in the United States is supplied primarily by the U.S. Foreign Agriculture Service described earlier, by the Food and Agriculture Organization of the United Nations, and by the news media

One hundred and thirty-one countries are members of the Food and Agricultural Organiztiion. Each member of FAO is obligated to forward to the FAO statistical staff all national data on food and fiber production, utilization, and related information as soon as it is published. The member countries have agreed also to forward to FAO headquarters in Rome other periodic information on food, agriculture, and nutrition. On the basis of these country reports, the FAO publishes an annual World Agricultural Production Yearbook, a Trade Yearbook, The State of Food and Agriculture an Annual Fertilizer Review and a Monthly Bulletin of Econonucs and statistics. Some 15 commodity subgroups also prepare regular and special reports on commodity problems.

FA0 data are less accurate than desired in many cases since the official statistics of many nations lack an objective basis and are f requentl y influenced by political considerations.

In 1968, the FAO also began the development of an early warning system. Under this system, monthly reports on food, crop Conditions, and the food situation are collected by FAO and the world food program field staff for over 70 developing countries. This early warning program is aimed at obtaining advance indications of possible emergency food and food aid needs. It is in addition to the estimates of current and prospective crops collected regularly as a part of FAO commodity market intelligence service which has been functioning for many years. Elsewhere in this report, recommendations for expanding this service, which were made by the 1974 World Food Conference, are discussed.

INTERNATIONAL WHEAT COUNCIL

Another international agency which compiles and publishes world wheat reduction and trade information is the International Wheat Council, located in London, with a membership made up of 10 exporting countries and 42 importing countries. In April, 1972, it began issuing monthly world market reports on wheat, which were authorized and reviewed by its advisory subcommittee on market conditions. In 1973, it issued its first annual forecast of the world wheat, supply and demand situation for the ensuing marketing year, 1973–74.

INTERNATIONAL COTTON ADV1SORY COMMITTEE

Since 1939 the major cotton producing and consuming countries have supported an International Cotton Advisory Committee, which, with a limited staff, compiles world information on cotton production, trade, stocks, and prices. This International Cotton Committee located in Washington, D. C., has 46 member countries. It issues a monthly review of the world cotton situation and quarterly bulletins containing world information on cotton production, imports, exports, prices, and stocks.

OTHER SOURCES (INTERNATIONAL)

In addition to these three international agencies, world information on sugar production supplies, and prices is compiled and published by the Licht Corp. in Germany. World information on oilseed production, supplies, and processing is compiled and published in "Oil World," by ISTA Mielke & Co., Hamburg, Germany. World information on grains is published by the Commonwealth Secretariate, London. World Information on fertilizer production capacity is compiled and published by the British Sulfur Corp. of London. Several other private institutions supply information on specific aspects of the world food industry.

Technical and Institutional Obsolescence of National Food and Agriculture Information System

OBSOLESCENCE

Many of the data series now being maintained by the Statistical Reporting Service and the Economic Research Service were designed 40 or 50 years ago. They were designed to provide information about food and agriculture at that time. To the extent that the structure of our food and agriculture industry has changed since then, these older data series are based on obsolete concepts, definitions, and measurements.

The nature and extent of this problem are described in some detail in a report of an American Agricultural Economics Association Committee in 1972 entitled, "Our Obsolete Data Systems: New Directions and New Opportunities."[4]

Examples of this obsolescence are found in two of the older established series. "Prices Received by Farmers and Cash Receipts From the Sale of Crops and Livestock." What was the average price received for broiler chickens last month? How much did broiler chicken sales contribute to farm income last month? Almost all broilers are raised under contract by local growers or are produced by integrated corporations engaged in all aspects of broiler production, from the production of the feeds used, to the marketing of the broilers. Under these conditions statisticians are forced to improvise.

The statisticians compute equivalent farm prices for broilers from prices reported for dressed broilers and from limited survey reports. These equivalent prices are applied to the weight of broilers slaughtered each month to obtain equivalent farm income from the sale of broilers.

This is only one example of the obsolescence in our older data series. The failure of administrative officials, charged with the collection and publication of these series to bring them up to date is closely related

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[4] American Journal of Agricultural Economics, vol. 54, No. 5, 1972, pp. 867–S75.

to interests that data users have in the continuity of a data series. Any proposed change in the series is seen as an advantage by some users but as a disadvantage by others.

Professor Bonnen of Michigan State University, who has studied this problem for several years observes that "* * * the great improvements in statistical methodology and data processing techniques over the last generation cannot offset failures at the conceptual level, for no matter how well quantified one is still measuring the wrong thing. * * * Management of da systems has grown far more sophisticated. But none of this is sufficient to offset the debilitating effect of being forced to measure something that in some major degree no longer exists.' [5]

We are concerned that, although a distinguished committee of the American Agricultural Economics Association urged action in dealing with these issues as long ago as 1972, efforts on the part of responsible administrators looking toward the improvement of these older data series have been frustrated by lack of public concern and support.

We recommend that either the Joint Economic Committee, or one or both of the Agriculture Committees, request the Secretary of Agriculture to establish an agricultural statistical review committee charged with the responsibility of making recommmdations to the Congress and appropriate executive agencies for modernizing, coordinating, and standardizing the older food and fiber data series. This agricultural 8tatistical review committee should? include members from the various disciplines and groups who utilize food and agricultural data.

TIMELINESS

Most national food and agricultural data series are released promptly. This has not been true, however, in recent years for the **agricultural census.** The first reports from the agricultural census of 1969 were not available for more than 2 years after the data were collected; the final reports were not issued until more than 4 years after the data were collected.

Fertilizer production data series also suffer from a lack of timeliness. The timeliness of other data series also could be improved. Usually when a data series is developed by an agency, which has little interest in, or need for, the data in its program operation:, the tabulation and release of the data are relegated to a second or thmd order of priority in its work schedule. For example, the administrator in charge of one of the fertilizer data series indicated his willingness to arrange for earlier scheduling of the tabulation and release of the data if the appropriate congressional committee chairman made such a. request.[8]

The collection of fertilizer information and its analysis and dissemination are shared by 10 governmental agencies and at least 2 industry-financed trade associations. There is substantial consensus among the users of this information that important improvements are possible, especially in terms of timeliness of the reports, increased reliability, and the publication of the scattered information in comprehensive monthly and annual reports.

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[5] Bonnen, James T., "Problems of the Agricultural Information Systems of the United States." Assessment of Food, Agriculture, and Nutrition Information Systems—working papers from Michigan State University, June 1975, pp. 7 and 15.

[8] Wilcox, Walter W., personal communication, December 1974.

We recommend that the several congressional committees having responsibility for the executive agencies which collect and publish the various series of data relating to fertilizer conduct studies and hearings to detemine ways, means, and cost of improving fertilizer infomation systems

AGRICULTURAL CENSUS

The timely collection and release of reliable benchmark data such as the 5-year agricultural census provided in the 1930s, 1940's, and 1950s has become a serious problem in the 1970s. In part, this is because of the changing structure and increased specialization in agriculture. Also, the labor costs involved in recruiting and training a field force sufficient to interview all farm families in the United States, as was done earlier, are almost prohibitive today.

As mentioned previously, the 1969 and 1974 censuses of agriculture were taken by use of mailed questionnaires with a heavy dependence on telephone calls to assure an acceptable response. This method was chosen primarily to reduce costs after preliminary tests indicated that such a method would give reasonably satisfactory results

In view of the shift to large probability samples by the Statistical Reporting Service, and the shift by the census Bureau from a complete enumerative agricultural census to a mailed questionnaire survey, the desirability of adding the census function for detailed and county - level data to tKe responsibilities of the Statistical Reporting Service. should be reviewed y Congress. An analysis of the feasibility and probable cost of making such a change, by a private consultant group, indicates the probability of obtaining more accurate benchmark data at no higher cost if the responsibility for collecting benchmark agricultural data were assigned to the Statistical Reporting Service.[7]

We recommend that the *congregressional committees, which have* juris*diction over the Department of Agriculture and the Bureau of Census activities study the desirability and feasibility of integrating the staff and activities of the Agricultural Census into the Statistical Reporting Service. Such a study, with hearings if needed, should be scheduled within the next calendar year. If the results support such a transfer appropriate legislatiion should be enacted providing for transfer of the responsibility for agricultural benchmark data to the Statistical Reporting Service when the processing of the 1976 agricultural census data is completed.*

FORECASTING DEFICIENCIES

The phenomenal increases in prices of grains and soybeans in the 1972-73 crop year were not predicted by analysts in the Economic Research Service or at the land grant universities. It appeared that the food supply and price forecasting system had failed to provide reliable information for planning and decisionmaking. what were the causes of this failure? What can and should be done to avoid the danger of another similar failure in the future?

Lack of information regarding stocks and the size of the 1972 world grain crop ***was*** a factor. Unexpectedly large Soviet purchases in world

[7] American Agribusiness Associates, "New Agricultural Data System Needed," duplicated. 1973, 15 pp.

grain markets sharply reduced market supplies. Domestic price controls influenced beef cattle marketing and the complex of oil seed products in ways that were not fully anticipated. There insubstantial agreement however, that the primary failure was analytical. The economic models and supply-demand-price equations> which had performed satisfactorily in the 1950's and 1960's, had little value when applied to the more dramatic changes that occurred in the domestic and world markets in the 1970's, such as the size of the 1972 world grain crops

The *lesson **of the** failure of the food and agriculture information system in 1972-73 is that we must have more information on food production and market demand in other parts of the world and our analytical capabilities must be increased.*

STRENGTHENING OF THE ECONOMIC RESEARCH AND FOREIGN AGRICULTURAL SERVICES ~NEEDED

In fiscal year 1972–73, when the failure in the international food information system occurred, Government was spending $61 million annually on the four basic national agricultural information agencies; the Statistical Reporting Service, the Economic Research Service, the Market News Service, and the Foreign Agricultural Service. Since early 1972, the Economic Research Service has been reorganized and minor reorganizations occurred in the other agencies. Additional funds were requested by the agencies to permit them to collect additional data and to provide for more analyses.

In part, as a result of these actions, appropriated funds for these four agencies were increased to $73 million in 1974-75, and appropriations of $80 million are being requested for the 1975-76 fiscal year. In terms of purchasing power, however, the $80 million requested is slightly less than these agencies received in 1972-73.

The General Accounting Office recently studied USDA's plan for an automatic data processing system and equipment to be acquired. It concluded USDA had not made needed cost-benefit analyses and should complete studies of data processing and communication requirements" %before investing in additional computers. USDA also was criticized for inadequate consideration of security to protect personal or other sensitive 7nformation.

USDA might better use additional funds for improving agricultural data and its analysis before investing in additional processing equipment.[8]

Important step s have been taken since 1972 to im rove the quality and timeliness o the information available on world agriculture an$ agricultural requisites, We believe, however, that additional improvements are needed.

The Foreign Agriculture Service should improve its information collection capabili~y by: Giving its attach4s basic training in data collection; expanding its reporting capabilities in the critical developing countries; improving its data transmission and the timeliness of

[s] Fox, Karl, "An Appraisal of Deficiencies in Food Price Forecasting for 1973, and Recommendations for Improvement," prepared at the request of Gary Seevers, member of the Council of Economic Advisers, 26

'Comptroller General of the Wr~~$\;~;;$' ;~~!;~g?anning-A Must Before a Departmentwlde Automation Data Processing $ystem Is' Acquired for the Department of .N@?ulture," LCD 75-108, June 3, 1975.

its summaries; improving its reports for the major commodities on probable import requirements of the importing countries; and improving its reports on world agricultural requisite supplies and requirements, especially fertilizer.

The Economic Research Service should improve its world information analysis capability by: Strengthening its ability to analyze, evaluate and interpret current world information on a monthly basis during the crop growing and early harvest seasons; increasing its ability to 'analyze current world weather data and interpret its significance in terms of probable crop production in the current season; and developing world models of production, utilization, trade and prices for the more important agricultural commodities, especially grains, which permit timely evaluation of new data on a monthly basis during the growing and early harvest season.

We *recommend that the Agriculture Committess of the Congress schedule hearings to determine what improvements in the Foreign Agriculture Service and the Economic Research Service have been made since 1972–73, and what further improvements* are ***feasible.***

Such hearings should focus on: Additional data series to be collected by the Foreign Agriculture Service; steps to increase the timeliness of reports issued; steps to improve the quality of the data obtained from abroad; and appraisals by the administrators of these services concerning additional improvements that could be made in existing information systems and the probable cost of achieving the improvements.

INFORMATION METHODOLOGY

Automatic data processing has contributed grcatly to both the timeliness of most statistical series and to the analytical capabilities of those engaged in the analysis of information relating to food and agriculture. The Economic Research Service maintains a national agricultural model which it uses to analyze alternative national agricultural program proposals. This model is also utilized to provide estimates relative to regional adjustments and to provide estimates for groups of commodities. It also maintains less comprehensive models for analytical purposes in preparing its periodic situation and outlook reports for the various commodities.

Members of the agricultural economics staffs at several State agricultural experiment stations, utilizing automatic data precessing, have developed models for one or more of the more important agricultural products in their States, none of which have been very useful thus far.

The University of California, Case-Western Reserve University, Iowa, State University, and Michigan State University, have developed models, in some, cases, for the United States, in some cases for the entire world, and in other cases for specific foreign countries.

The 1972 failure of the agricultural information system indicates the need and desirability of building and maintaining international modcls on a selective basis dealing with the problems of relevance to the Congress.[10] International market forces of demand and supply are continually changing due to changes in population, income distribution, weather, governmental policies, and other factors. These market

[10] Johnson, Glenn, "Technology of Information Systems," Assessment of Food, Agriculture, and Nutrition Systems—working papers from Michigan State University, June 1975.

forces need to be modeled for individual countries so that both the executive agencies and the relevant committees of Congress can formulate appropriate policies. The need for building international models has increased as world trade in food has increased in recent years. The need will increase even more in the years ahead.

The Department of Agriculture has joined with the National Aeronautics and Space Administration and the National Oceanic and Atmospheric Administration to test whether the use of data gathered by the second Earth Resources Satellite (ERTS-B)[11] launched in January 1975, and analyzed with the aid of computers, can improve the timeliness and accuracy of major crop forecasts. This project, large area crop inventory experiment (LACIE), at the outset will concentrate on wheat grown in North America.[12] It will combine crop acreage measurements from ERTS-B data and meteorological information from NOAA satellites and from ground stations. It is designed to relate weather conditions to yield assessment and ultimately to production forecasts.

The National Oceanic and Atmospheric Administration is also cooperating with the Statistical Reporting Service in the analysis of weather data as related to crop yields in the major agricultural areas of the United States. One of the objectives of such analyses is to discover weather-yield relationships which can be applied in those parts of the world where reliable information from other sources is not available.

*We note with approval the plans for expanding weather-crop yield research. We believe it is urgent thut the experiments and analyses utiliizing new technologies for obtaining and analyzing data go **forward on an** expanding scale as preliminary results, including cost effectiveness analysis justify. These newer technologies offer great promise for the years ahead.*

Reliabnility and Timeliness deficiencies of International Food and Agriculture Information Systems

THE 1972–73 INFORMATION SYSTEM FAILURE

The failure in the world food information system in 1972-73 was caused partly by gaps in the information on world grain production and trade and partly by a failure to analyze adequately the information which was avalable. In a report prepared for the Ford Foundation, by the former deputy director general of FAO, several gaps in world food information systems, as they existed in mid-1972, were identified:

1. The U.S. had no current reporting system on sale of grain for export.
2. The absence of current estimates of probable grain production as well as stocks for the U.S.S.R. and the People's Republic of China.
3. The need for better estimates, or at least qualitative evaluations of current crop conditions or prospects in most of the developing countries.
4. The need for better stock statistics in most commercial importing countries, including U.S. S.R. and the People's Republic of China,
5. The need for more current and better information on the availability of production requisites for the developing countries, especially fertilizer.

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[11] Since renamed Landsat.

[12] National Aeronautics and Space Administration, press release, 74–294, November 6, 1974.

6. The need for more reliable indications as to the probable flexibility of production in some of the main producing countries, especially for the United States, India, Brazil and the U. S. S. R.~

This report also states that:

> *** • * most of the failure to forecast or understand the** seriousness of the world food situation in the summer of 1972 and again in the summer of 1973 was more a matter of analysis and political desire than of statistical intelligence.1'

These findings were preliminary to the major conclusion of the report:

> **The consultant recommends that the foundations and related institutions interested in the world food situation should give serious consideration to the establishment of an autonomous International Food Policy Institute * • * which would give attention to the development and dissemination of food policy and food situation analyses with especial reference to the immediate operating needs of the underdeveloped world.[m]**

It was proposed that such an institute should prepare a series of reports, seminars, and conferences on the food problems of the less developed countries.

The World Bank, FAO, and other international agricultural agencies have pledged their cooperation and have endorsed the establishment of such an institute. Plans for an institute, financed by a consortium of private foundations in the United States, Canada, and other countries, have progressed to the point that an acting director has been appointed and organization activities are underway.

When this new autonomous International Food Policy Institute begins to function it should eliminate a current weakness of the other international agricultural agencies: their inability to publish information and analyses, other than those approved by mem%er governments.

FAO TIMELINESS PROBLEMS

The Food and Agriculture Organization of the United Nations is recognized as the major source of information on world agriculture. Expectations for improving the world's information system must be based upon an assessment of international capability. There are several generally recognized deficiencies in the information collected and published the FAO.

& The time apses between the collection of data in the various countries and their availability in the FAO publications is so peat that most series are only of value for historical research. The Information reported in the monthly bulletins of Economics and Statistics are more timely than those published in the annual yearbooks, yet even in these publications there is usually *a* lag of 6 months or more between the collection of the country data and the availability of the regional and world summaries in the monthly bulletins.

CENTRALLY PL.4NNED COUNTRY DATA GAP

Another deficiency is the gap in world food and agriculture information created by the failure of U.S.S.R. and other centrally planned countries to supply accurate national data to FAO on a timely basis.

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[13] **Wells, O. V., "Improving World Food Situation Outlook Information and Analysis," phase II report. Ford Foundation, April 1974 (duplicated), pp. 4 and 5.**

[14] **Ibid., p. 6.**

[15] **Ibid., p. 7.**

Acreage data are released on a timely basis by the U. S.S.R., but thus far little information on either acreage or production is made available from the People's Republic of China.

DEVELOPING COUNTRIES' PROBLEMS

In perhaps 100 or more of the developing countries, the national information systems are so poorly staffed that the data supplied by FAO is lacking in reliability.” There is great variation in the agricultural information systems found in these less developed countries. Many countries lack even a recent census of agriculture. Others have agricultural census data collected at regular intervals supplemented by sample surveys and by reports of knowledgeable people at regular periods throughout the year.

Each year or the past 10 years or more the FAO has stationed 25 to 40 technically trained experts in underdeveloped countries for the purpose of helping the national governments improve their statistical services. The technically trained FAO staff member is usually stationed in a country for a full year or more to enable 'him to train local personnel in the collection and dissemination of agricultural information.”

Even though this program has been in operation for a number of years, and the United States through its AID financing has provided training for personnel from many underdeveloped countries, agricultural information systems in many of these countries continue to be inadequately staffed and poorly financed.

The inadequacies of the food and agricultural information systems in the developing countries create serious problems for international agencies, which attempt to assemble world food and agricultural statistics. This is an area where the United States has made important contributions in the past through AID-financed technical assistance activities. Congress has given a high priority to food and agriculture in legislative authorizations for AID.

We recommend that Congress direct AID to increase its technical assistance for improvement of agricultural information systems, including the introduction of advanced information. technology, in developing countries now most deficient in their agrcultural statistical instititutions

FAO and other international agencies also encounter the problem of national governments which are sometimes unwilling to release unbiased data because of the fear of encountering problems with an important segment of their citizens. Situations have occurred where the national government believed it to be to its advantage for example, not to release its best estimate of national crop production in a drought -year. Rather, the government released estimates which were believ eto best suit its political purposes. FAO and other international agencies including the USDA, usually must accept the data supplied by the national governments. This is a potential weakness in all data gathered and released by international organizations and a serious handicap to all who use the data.

We *recommend that* Congress *request the U.S. representatives with supervisory responsibilities for international information agencies to*

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[16] Ibid., p. 10.
[17] Ibid., p. 21.

support the development of rules and regulations for the international professional *8taff which would* authorize *and* direct *these Staffs to use tbe most reliable information available to them wlien compiling their reports.*

FAO : EARLY WARNING SYSTEM

In 1968, recognizing the lack of timeliness in most of its data series, FAO began the development of an early warning system. Under this system, monthly reports on food crop conditions and the food situation are collected by FAO and the world food program staff for over 70 developing countries. This early warning program is aimed at obtaining advance indications of possible emergency food aid needs. These early warning reports are in addition to estimates of current and prospective crops collected regularly as a part of an FAO market intelligence service, which has been?functionmg for many years

The 1973 FAO conference authorized funds for an expansion of the early warning system.[18] An expanded program was established in March 1974, but even the new program failed to meet the needs in this area and, as will be reported more fully later, the World Food Conference in November 1974, adopted resolutions calling for its further improvement.

Although the early warning reports of FAO have been helpful in providing information at an ear y date on food crop conditions in countries in danger of requiring emergency food aid, the reports have been in qualitative terms. They seldom have contained quantitative estimates and seldom have been sufficiently documented to provide a basis for estimating the food import requirements of the countries.

This early warning food information system, stalled by the FAO and the world food prqgram, provides the most timely information available during the crop growing season for some 7O developing countries. The FAO commodity intelligence service collects similar crop progress information m the developed countries, and as a follow-up to the 1974 World Food Conference, is developing timely information during the growing and early harvest season for all countries on a regional and world basis.

INTERNATIONAL WHEAT COUNCIL

The International Wheat Council, located in London, with 10 exporting members and 42 importing members, began issuing monthly and annual reports on the world wheat supply and demand situation in 1972. These reports are issued on a time y basis and appear to be comprehensive. The Soviet Union, although not a member of the FAO, is a cooperating member of the International Wheat Council.

The monthly and annual reports, including forecasts for the marketing year ahead. are prepared by the Council's advisory committee or a subcommittee on market conditions under the guidance of the executive committee of the council. Before a final report is released, each country represented on the executive committee has an opportunity to review it. Thus far the Council has not adopted procedures to guard against possible exercise of undue influence on the content of a report by some member of the executive committee.

[18] Ibid., p. 5.

WORLD WEATHER DATA

At the present time, the field staff of the FAO and the world food program prepare qualitative re ports on the weather as it has affected crop production in the country or which they are making early warning reports. The U.S Foreign Agricultural Service also receives and assesses weather data for impotant agricultural areas of the world in developing its current estimates of world production of the major foodstuffs.

A current major problem encountered in the use of weather data is . that the global telecommunications systems was designed primarily to service aviation. Data important for a "cultural assessments particularly precipitation, are not required to e transmitted regularly and on a timely basis. There is also a lack of uniformity in codes and fre- . quency of sending precipitation data between various regions.[19]

FAO, in its proposals for national and international action at the November 1974, World Food Conference proposed requestin the World Meteorological System to provide regular assessments of current and recent weather data assembled by the World Weather Watch to identify agriculturally significant changes in weather patterns and related information. These assessments by the World Meteorological System, when they are undertaken, should improve our information on the progress of crops m those sections of the world where gaps now exist.

AERIAL PHOTO/REMOTE SENSING~~

FAO is now cooperating with national governments in the experimental use of aerial photography to collect more accurate and timely informatl~n on crops and livstock numbers. Its staff is also studying the feasibility of remote sensing as *a* means of obtaining agricultural data in countries where gaps now exist. Serious political problems in the collection and release of remote sensing data, as well as t e high cost of processing them, make it unlikely that remote sensing will close existing information gaps in the near future.

IMPROVEMENTS NEEDED

More comprehensive, more accurate, and more timely information on ' world food and agriculture is needed now and will continue to be needed in the years ahead. In a later section the resolutions relating to these issues, which were adopted by the 1974 world conference, will be discussed. Because of the sensitive political considerations of its membership, however, FAO may be unable in the near future to achieve its goals in the improvement of the world food and agricultural reformation system.[20]

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[19] Wilcox, Walter W., "Technical Assessment of International Food andAgriculture Information Systems," Asessment of Food Agriculture, and Nutrition Information Systems—working papers from Michigan State University, June 1975.

[20] Sorensen, Vernon L., and Ferris, John, "mpact of International Food Production and Trade on U.S. Agriculture System and Needs for Development of the Relevant Information System," Assessment of Food, Agriculture, and Nutrition on Information Systems-working papers from Michigan State University, June 1975.

FOOD DISAPPEARANCE DATA

Throughout the world food disappearance data are utilized as an indirect measure of the nutritional adequacy of food consumption. Most developed **countries have reliable information** on food disappearance and also have substantial information on the nutritional status of their citizens. In the developing countries, however, credible food and agriculture data often are lacking. Nevertheless, these questionable food data are relied on as almost the only indication available of the nutritional status and the extent of undernutrition in these countries.

limited numbers of nutrition surveys have been conducted by United Nations and U.S. AID agencies such as the National Food and Nutrition Survey" of Barbados [21] and '(The Tamil Nadu Nutrition Study" in India.[22] For the most part, however, nutritional status information is inferred from food availability and disappearance data. Largely from such data the FAO Preliminary Assessment of the World Food Situation for the 1974 World Food Conference concludes, that at least 400 million people in 1970 were suffering from malnutrition.[23]

In the United States there is a plethora of information relative to food availability and disappearance. The Department of Agriculture each year publishes in Agricultural Statistics" information on (1) quantities of 12 food nutrients available for consumption per capita, per day, (2) percentage of total nutrients contributed by major food **groups, (3) index** of per capita food consumption major food groups, and (4) per capita consumption in retail weigh t equivalent, by major food groups. It also publishes a 25- to 30-page National Food Situation four times a year. This publication contains information on food prices, current trends in food spending and income, per capita food consumption (disappearance) by 3-month periods, and aggregate food supply and utilization information. There also is much research information available relative to the nutritive content of specific foods and diets.

FOOD AND NUTRITION BOARD

One of the first national nutritional status studies was that of the pnational Nutrition Conference for Defense convened in 1941 by the Food and Nutrition Board of the Nationa] Research Council and several governmental agencies. It reported findings of poor diets and nutritional deficiencies at all socioeconomic levels the lower the levels of income and education, the more frequent and the more serious the problem. The groups noted to be especially vulnerable at that time were preschool children, pregnant women, nursing mothers, and adolescent girls. This 1941 conference report was based on dietary and clinical

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[21] Scientific Publication No. 237, Pan American Health Organization, 1972.

[22] Report t. U.S. AID on Contract No. AID/nesa-399 by Sidney M. Cantor Associates, Inc., July 6, 1973.

[23] Prof. Thomas T. Poleman, discusses the inadequacy of Information On food consumption in the less developed countries, in "World Food: A Perspective," Science, May 1975. pp. 510–518.

nutrition studies during the Great Depression of the 1930's and examinations of men called up for military service.

Following the 1941 National Nutrition Conference, the Food and Nutrition Board made studies and issued reports on nutrient requirement, food composition, enrichment of grain products industrial feeding , nutritional survey techniques an their value, composition of milk, heat injury to protein, maternal and child nutrition, and other matters of health importance related to food and nutrition. It is perhaps best known for its '(Recommended Dietary Allowances" (RDA) first issued in 1941 and continuously revised as more evidence becomes available on the nutrient requirements of man. The eighth edition of the allowances was published in 1974.[24]

HUNGER AND NUTRITIONAL DEFICIENCIES IN THE 1960'S

Food consumption studies conducted by the Department of Agriculture in 1945 and 1955 indicated that diets had improved substantially. The 1965 surveys however, indicated that the nutritional status of important population groups had deteriorated. This survey was followed in 1967 with several reports of large pockets of hunger and nutritional deficiencies among the poor in America.

A Senate Subcommittee on Manpower, Employment and Poverty held hearings in Jackson, Miss., and visited the home of poverty stricken rural families in the summer of 1967. The evidence of hunger and nutritional deficiencies observed by the Senators led the Field Foundation to take the leadership in creating a "National Council on Hunger and Malnutrition in the United States." The activities of this National Council led to a public airing of the hunger problem by the news media. It also led to the creation in the Senate of a Select Committee on Nutrition and Human Needs.

As a result of this new concern, Congress, in December 1967, authorized the Public Health Service to conduct a survey of the nutritional status of Americans living in low-income areas. This survey was conducted in select low-income sections of 10 States and New York City . Information from this survey and from other related activities, including the hearings of the Select Senate Committee on Nutrition and Human Needs, was used to support the expansion of governmental food assistance and nutritional education programs. The widespread interest created in these problems led to the convening of a White House Conference on Food, Nutrition and Health in December 1969. This conference made numerous recommendations for improving the government food assistance programs and for the expansion o nutrition research and educational activities. It also recommended that the commercial food industry improve the nutritional content of processed foods.

FEDERAL FOOD ASSISTANCE PROGRAMS

Since Congress each year must provide the funds for the food assistance program for special groups, and for nutrition research and education programs, its first interest is in information for the evaluation of the effectiveness of these programs.

[24] Food and Nutrition Board, National Academy of Sciences, pamphlet, March 1975, 25 pp.

Congress has authorized a substantial number of food assistance programs: Food stamps: commodity donations for needy families, for institution?, and for feedng programs for the elderly; other supplemental feeding programs including a program for pregnant women and infant children; special school milk program; school lunch and school breakfast programs; and day care and Head Start feeding programs.

The appropriations for these programs, including the Federal Government's share of administrative expenses in fiscal year 19'75, were $6.1 billion. Appropriations for nutrition research and educational activities of the Federal Government also exceed $50 million annually.

The Food Advisory Committee found that to date only limited and fragmentary program evaluation studies have been made by the administering agencies. It noted that the U.S. Court of Appeals in June 1975, ruled that the Department of Agriculture is not complying with the legal requirements of the 1971 amendments to the Food Stamp Act which in effect, directs the USDA to provide food stamp allotments which will assure low-income households the opportunity for an adequate diet.[25] Additional program evaluation studies are urgently needed to improve the administration of Food Stamp and related food assistance programs.

We recommend that the Congress direct the Food and Nutrition Service which administers the food assitance program to expand its program evaluation studies. These studies should be integrated to maximize their cost effectivenes and ensure getting the quality and type of information necessary to make appropriate evaluation8.

NUTRITIONAL STATUS MONITORING PROGRAM NEEDED

As part of a national food and nutrition policy, a national nutritional status monitoring and surveillance program is needed. A total of 906 bills dealing with food and nutrition were introduced into the 93d Congress. The principal nutrition issues appear to be: Poverty as the principal correlate of hunger and nutritional deficiencies; the extent of nutritional deficiencies associated with distorted food behavior, including overconsumption, found at all social and economic levels in the United States; food and nutritional needs of special groups, such as pregnant women, preschool children, ethnic minorities, and the aged; the effects of a major transfer of food preparation and service responsibilities to the commercial sector; and the quality and safety of the food supply.[26]

A panel of the 1969 White House Conference considered the need for a continuing monitoring system of dietary and nutritional evaluation. It reported:

> All members of the Panel agreed there are two basic objectives for which we should strive:
>
> 1. Monitor: Evaluate and re-evaluate nutritional status of samples of Americans to measure effectiveness of programs being applied to improve nutritional status.

[25] *Rodway* v. *U.S. Department of Agriculture*, D.C. Circuit, docket No. 74–1303, decided June 12, 1975.

[26] Sidney M. Cantor Associates, Inc., Preliminary Technology Assessment of U.S. Food, Nutrition, and Agricultural Information Systems—Food Consumption and Nutrition Status Contract Report OTA–C–7, November 1974.

2. Surveillance: Comprehensively evaluate the population at large to identify potential problems before many people are affected and to provide a continuing reference base * * *

The role of nutritional surveillance and monitoring systems must be to gather data that will serve as the basis of applied nutrition programs aimed at the improvement of the nutritional status of the American population with emphasis on the poor. * * *

To date little followup action has been taken on these White House Conference recommendations. The Nutrition and Special Groups Panel of the June 1974, National Nutrition Policy Study was concerned by the failure to make progress in this area. They reported, '(Since World War II there have been hundreds of studies done of the nutritional status of Americans. These included dietary, biochemical and clinical assessments * * *

What is of particular concern to us is that results of the most recent studies add little to our knowledge and completely ignore questions which we feel must be answered if the United States is to develop a sane and equitable nutrition policy.

Meaningful food consumption and nutrition surveillance information is far more difficult and far more costly to obtain than comparable information on food production. This arises primarily because of the difficulty of measuring nutritional deficiencies and related food consumption. In part, the high cost is because existing technologies require clinical analysis as a, part of a comprehensive evaluation of an individnal's nutritional status.

Nutrition scientists also arc not fully agreed on the significance and rcliability of specific tests for nutritional deficiencies. Information on nutritional status also involves consideration of nutritional-related public health issues, where in many instances cause and effect relationships are not clearly established. It is because of these problems that little progress has been made in establishing a monitoring and surveillance program as recommended by the 1969 White House Conference.

INTEGRATION OF HEALTH AND NUTRITION- AND FOOD Comsummo~ SUR~'EI'S

The National Center for Health Statistics, HEW, is now carrying Out Health and Nutrition Examination Surveys to obtain data of epidemiological quality for use in national health program planning. The small samples used in these surveys and the time elapsed between gathering the data and publishing the results limit their usefulness.

Plans also have been substantially completed by the Consumer and food Economics Institute of the Agricultural Research Service to conduct a nationwide household food consumption survey in 1977. This survcy using improved design and methodologies would be a continuation of similar surveys started in 1935, the last one occurring in 1965 In previous household food consumption surveys, the design of the schedule has been so deficient that the nutrition data could not I)e related to important economic and social characteristics: these surveys lmte been limited in their usefulness, a deficiency which can be corrected in future surveys.

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[27] "White House Conference on Food, Nutrition, and Health, Final Report, 1969," pp. 24–25.

[28] Hearings before the Senate Select Committee on Nutrition and Human Needs, pt. 3—Nutrition and Special Groups, June 19, 1974, p. S40.

Statisticians and automatic data processing specialists are helping the consumer and food economics staff develop plans which will utilize the latest developments in sampling theory, automatic data processing and information transmission.

Current planning, which is being monitored by the Office of Management and Budget, revolves the active cooperation and participation on the part of the Food and Nutrition Service, the Economic Research Service, the Social Security Administration, the Food and Drug Administration, and the National Marine Fisheries Service. Food consumption data for the individual members of the household will be placed in data banks, where they will be available for research use at the land grant universities and elsewhere within a year after the data are collected.

This survey, if adequately planned and carried through, should provide the food consumption data base for a continuing nutritional status surveillance program. If the Health and Nutrition Surveys of HEW were expanded on a probability sample basis, and methods of handling the data improved, these data, combined with relevant food consumption information, could be organized and analyzed by a competent staff to serve as a minimum national nutrition surveillance system.

We recommend that, as a first step in developing a national nutritional monitoring and surveillance program the Senate Select Committee on Nutrition and Human Needs hold hearings on the adequacy of design and integration of the ongoing nutrition surveys conducted by the Department of Health, Education, and Welfare and the planned household food consumption survey to be conducted by the Department of Agriculture.

The administrators responsible for these surveys should be asked to report on their current activities and plans for the next few years. They should be asked to report on how data from one survey supplements that obtained from the other, and how the information from both surveys taken together might 'be analyzed to determine more adequately the nutritional status of population groups. Questions also should be raised regarding plans for analyzing the data and relating them to the economic and social characteristics of the individuals in the households. Are research staffs in HEW, USDA, or the land grant universities making plans to analyze data from both surveys as they relate to each other?

The Food Advisory Committee plans to consult further with leading nutrition scientists and at a later date make recommendations for establishing a continuing nutritional status surveillance program.

World Food Conference Recommmuiatioms for Improving

SCOPE OF RESOLUTION

Resolution XVI of the 1974 World Food Conference is entitled "Global Information and Early-Warning System on Food and agriculture." Its first paragraph states that the capacity of governments to take prompt and appropriate measures to deal with food shortages would be enhanced if all countries could receive timely information concerning the current and prospective world crops and food situation.

It then stresses the urgent need for a global food information system which would provide early warning by (a) identifying countries and regions where acute food shortages and malnutrition problems are expected before another crop is harvested and (b) by monitoring world food supply-demand conditions. It emphasized the important role played by comprehensive and timely information relative to prospects for agricultural production, import requirements, export availabihties, livestock health, and inputs in meeting the requirements of world food security and market stability.[29]

The opening paragraphs also recognize that the areas most severely affected by food shortages, and those where timely and adequate information is most needed, often do not possess the necessary resources and data collection institutions to provide the information needed.

The resolution then states that all major food producing and consuming countries have expressed their willingness in principle to participate in expanding the existing information arrangements into a more comprehensive and global system and Resolves that a global information and early warning system on food and agriculture should be established and agrees that FAO is the most appropriate organization to operate and supervise the system. * * * Requests FAO, in cooperation with other concerned international organizations, particularly the International Wheat Council, to formulated arrangements necessary for the establishment of the system, and to submit them for final approval by governments participating in the system." It requests that the information collected be fully analyzed and disseminated periodically to all participating governments for their exclusive use; it being understood that, where requested. certain information provided by governments would be disseminated only in aggregate form to avoid possible unfavorable market effects.

The final paragraphs of the resolution are devoted to requests for cooperation on the part of all participating governments and other international organizations. These requests cover three broad areas.

(1) Cooperation of all national governments in supplying on a voluntary and regular basis current information and forecasts on the basic food products in particular, and on all other relevant aspects of food and agriculture in their country.

(2) Cooperation on the part of FAO, the World Meteorological Organization, the World Health Organization, and other multilateral and bilateral sources to assist interested governments, both technically and financially, in strengthening their data collection and dissemination in the fields of food production, nutrition levels at various income levels, input supplies, meteorology, and crop/weather relationships.

(3) Cooperation on the part of the World Meteorological Organization and the FAO in expanding their regular assessments of current and recent weather data assembled through the World Weather Watch by: establishing joint research projects, particularly in the arid and semiarid areas; strengthening the global weather monitoring and data processing systems, making them more directly relevant to agricultural needs; and undertaking investigations of the probability of adverse weather occurring in various agricultural areas and obtaining a better understanding of the causes of climatic variations.

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[29] FAO Global Information and Early Warning System on Food and Agriculture-Proposed Working Arrangements, Annex 13, FAO (duplicated), March 1975.

POSTCONFERENCE ACTIONS

The FAO Council at its regular meeting in November 1974, a greed that the Global Information and Earl Warning System on F Agriculture as recommended by the orld Food Conference should be established in FAO and requested the Director General to set up the system as soon as possible.

A statement of proposed working arrangements was prepared by the staff for review and approval of the council at a special session in March 1975.[30] The proposed working arrangements were then transmitted to the FAO and U.N. member states with an invitation to each to participate in it. FAO proposes to put the new system in full operation by the end of June 1975. The expenses of putting the system into full operation are to be met in 1975–76 out of the regular budget.

Organization and scope of current plans

The senior officer in the Commodity and Trades Division of the Economic and Social Policy Department, FAO, will be responsible for the preparation of the reports issued and for relations with participating governments.

The new system will operate through an interdepartmental food outlook board. The food outlook board will preview the FAO outlook statements and periodically advise on the operation of the system with a view to improving its effectiveness. A number of divisional and regional offices will be involved in servicing the system, primarily b expanding their traditional activities. Information on fertilizers will come from estimates of the working party on fertilizer statistics and information supplied from other sources. Each participating government will be invited to appoint a liaison officer to facilitate t e transmission of national data to the FAO and to expedite distribution of the reports to the countries.

As currently proposed, the new system will produce four types of reports:

(1) Monthly food situation reports, a quarterly food outlook report, and s special reports on urgent food situations;

(2) Month y early warning reports containing the latest information on basic food crop conditions and food deficits or food availabilities in over 90 developing and developed countries;

(3) Quarterly food aid bulletin on bilateral and multilateral food aid and status and evaluation reports on world food stocks and storage capacity;

(4) Reports on fertilizer and pesticide supplies, deficits, prices, contracts and capacities which will be issue on a quarterly basis if feasible.

Long-term *improvement of basic data*

The plans for implementing the Global Information and Earl Warning System on Food an Agriculture, approved by the FAO Council in March 1975, included a section on improvement of basic data.[32]

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[30] Ibid., p. 1.
[31] Ibid., p. 3.
[32] Ibid., p. 6.

FAO proposes to provide more technical assistance to individual countries for improving methods of reporting on current harvests and crop conditions, utilizing funds made available by U.N. development programs and bilateral donors.

FAO and WHO staffs are currently considering ways of carrying out joint research projects to investigate weather-crop relationships.

FAO plans to extend its work in the field of remote sensing. It will explore the feasibility of organizing international cooperative action in this field with a pilot project on wheat.

FAO and WHO staffs, as requested by the World Food Conference, are currently working on the development of a global nutrition surveillance s stem. Possibilities will be explored of linking food information anJnutrition surveillance systems.

The FAO may not be able to achieve all the goals it has set for itself in the next few years in its plans for implementing the World Food Conference resolution, If this roves to be true, the staff should be encouraged to consult with member governments and establish priorities among the goals and adjust its development plans in line with this appraisal.

we *?'ecomlnw no? that the United* 8tafe8 *strengthen it$ own infornuztion agencie8, but, in a&Wbn, the firniteii ~Ytate8 can and 8bu.M prow%% incmxwea? fkuw"ai? arul teclinicul aa8&tance for FAO infownation actimWe8.*

The USDA @aff together with other members of the American delegation to the 1974 World Food Conference prepared background documents that were of substantial value to the conference and FAO. The Secretary of Agriculture should continue to cooperate fully with FAO and assist it in solving technical problems encountered in implementing the World Food Conference resolution and provide increased financial assistance for this purpose. 7J.S. representatives stationed in foreign countries might well be given instructions to assist the F.40 liaison officers to the extent possible in supplying reliable information to F.40.

Chairman HUMPHREY. Mr. Bell, before you begin I would like to make a few points.

It seems to me that the one key issue with respect to Soviet purchases of U.S. agricultural commodities is their insistence on buying secretly and buying big. This causes disruptions in the market. It also in a very real rense, limits competition, as only a few firms can really sell in such big orders. And it means higher prices and a higher than normal degree of interest in the sales on the part of the public and the press.

In looking over some of the purchases last year, the Chinese actually bought more wheat and corn from the United States than the Russians. But the fact is that there is hardly any notice of this, except in some specialized agricultural publications. This is because the Chinese bought into our market in an orderly way, purchasing four, five, or six shiploads every week or two, rather than millions of tons at a time.

The Russians are the only importers who insist on these one-time high-volume purchases. If they were to buy in an orderly fashion like the Chinese, the Brazilians, and even the Indians-who last year were one of our biggest customers-there would be more competition among

U.S. exporters. For example, the co-ops such as the Grain Terminal Association in Minnesota, would be able to complete. Actually. I believe the Soviets pay a higher price by buying huge amounts all at one time.

According to my information—and this is subject to some variables—there are about 18 U.S. companies that can handle four or five cargo sales per week But there are only three companies that can put together 5-million-ton sales.

one-term agreements, such as those being discussed in connection with the United States-Soviet grain trade, really are more window-dressing than solid substance.

If the Russians have a short crop, they are going to buy. If we have a good crop we are going to sell. And if we don't have a good crop, we can't sell.

1t seems to me we need to take a look at the overall marketing system. This system, as I am sure Sir. Bell will concur, is to a very large measure based on adequate information as to availabilities, crop plant ing intentions, and predictions.

At this point Mr. Bell, let us hear your testimony.

STATEMENT OF RICHARD E, BELL, ASSISTANT SECRETARY FOR INTERNATIONAL AFFAIRS AND COMMODITY" PROGRAMS, U.S. DEPARTMENT OF AGRICULTURE

Mr. BELL. Fine, Mr. chairman. I, like you, would like to present for the record my formal statement and make a few brief comments about it.

I do appreciate the opportunity to be here this afternoon to talk a bit about what, we arc doing to improve our data in terms of the analysis of soviet agriculture. You had also asked us to talk about the People's Repubhc of China.

And in that respect I wonld like to say at the beginning that we are vel~ limited on our information and our information exchange with China at the present time.

We have no formal agreement like w-e do with the Soviets. We do have a few teams which have bcen out there and library and exchange of teams and seed and so forth. We also lately have been able to get our agricultural officer in Hong Kong to make a visit to china and prepare us a series of reports.

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We do hope soon. partly through your efforts, to be able to say that we have an agricultural officer at the Liaison office in Peking.

Chairman Humphrey. Is that being negotiated now?

fr. ~ELI,. yes; it is. }y7e ha}"e had extensive discussions with the ~el)artnwnt of State and we have basical]y agreed on the format and I would hope that that would happen witfiin the next several months. so that ?w the end Of 1!)Ts we wi]l have someone on the staff in the ~iaison office 'in ~eling w11o will k]ooking after a~riculture most of the tinier.

Now, with respect to the Soviets themselves, the Soviet Union and our analysis of that, I would like to mention two things which I think are si~lficant developments in the past couple of years.

one of them is our agricultural cooperation a~reement vvhich vms signed in June 1973 with the l!?ioviets. And, second, about some of tho efforts we are making to improve our efforts to work better within the various agencies within the Government itself.

In the agreement that was signed in June 1973, there are two parts. There is a technology exchange section and then there is an information exchange agreement. We from the United States were more interested in the information exchange, the Soviets were more interested in technology exchange.

We move soon after the signing of the agreement in late 1973 to establish the form for the work under that agreement. It takes the form of a working group on exchange of economic information. We now have almost 2 years of work under our belts on that. We believe it has been useful. We still have a couple of areas which we think we still need to make improvements.

In the beginning we asked the Soviets to supply us on a regular basis each month with 10 categories of data regardingdevelopments in their own economy . They have been quite responsibfe in supplying us with those data. hey have arrived generally maybe a month to 6 weeks. late. They generally have arrived and they have been what we have asked for.

It has enabled us to get information on what is going on in the Soviet farm economy sooner than it was before that. We get data that is not published m the Soviet Union itself 3 or 4 months in advance. And that has been useful to us, particularly in trying to decide how the Soviet economy is going.

We have also been a)e to get some data which are new data, which are not published on a r eglar basis or at all, particularly on oil see.' production, on livestock s slaughter by months, and on the use of fertilizer by crops. They have been cooperative in that.

One of the areas which we have not been successful in is in getting the Soviets to provide us data on forward estimates. This is crop forecasting and the implications for trade. We have had meeting after meeting on that and we have at this sta e made no progress.

Chairman HUMPHREY. Why do you t ink that is, Secretary Bell?

Mr. BELL. I think it comes about in part because of the system they are involved in. They, of course, have 5-year plans, which are made up of annual plans. The annual plans, of course, are always quite ambitious. And when we ask for forward estimates, they say, well, , this is what the plan says. And not until the year has been completed will they admit that the plan was not fulfilled. And it gets involved in how the system works.

1 am confident, though, that there are regular data which are flowing toward Moscow on the crop conditions and the crop situation during the harvest. How this is put together and who it goes to we have been unable to really find out, though we did have a team over there that did look at how they gather statistics and so forth.

Hopefully, some day we will be able to tap into that system and get something. But as of now we have not.

We have attempted to replace our lack of availability of that data by sending in teams. In the early days we had resistance on the part of the Soviets on that, but this year we have been able to get a winter wheat team in, we have been able to get a spring wheat team into the Soviet Union, and now we have a sunflower team which is just about to return.

The winter wheat team was very useful to us this year. They in fact got far enough east in the country to be able to see the drought area in the Volga Valley, which was our real confirmation from the other data that we had that there was a drought going on.

So in general the agreement has been useful to us; it enables us to understand the Soviet economy a lot better than we did; it enables us to meet many more Soviet people than we had ever before—we have people constantly going in and out.

I think, though , that the area that we have done as much as anything that has helped our analysis in the past 2 years has been the efforts taken on our own to organize ourselves better. We have in particular moved to use the weather data which is available to us. We have a system set up with the U.S. Air Force where we get computerized raw data from the Air Force every 10 days, which gives us data on precipitation, data on temperatures, and a computation of what we call soil moisture.

Chairman HUMPHREY. You used to have a system in which it came over to Virginia and would sit there for 2 or 3 weeks.

Mr. BELL. We now get that 5 days after the decade for the decade.

Chairman HUMPHREY. You know that Senator Bellmen and myself traveled to the Soviet Union right after the 1972 wheat sale and discussed these matters with the Soviet Chairman of the Council of Ministers, Mr. Kosygin, and with Mr. Matseyevich, at that time the Minister of Agriculture. He has been replaced since then.

It was during those discussions that we were able to have Mr. Kosygin agree t at he would be prepared to enter into a bilateral arrangement. We wired Secretary Butz from the Embassy that we hoped they would proceed. We also brought great pressure to bear to increase the number of U.S. agricultural attaches. At the time, you remember, we had only one attache there. Now we have two, I believe.

Mr. BELL. We have an agricultural attache and we have two assistants. And the main thin that that enables us to do is to have the attaches traveling more. The Ambassador insists, and I think right - fully so, that one man be in the Embassy all the time for hishelp. his meant with only one additional man, you Couldn't cover much of the country. So with two we can actually have two out at the same time and still one to cover the office itself.

So we appreciate the help that you and Senator Bellmen gave us on that, as you have done here in the case of Peking, and it as been a lot of help.

These weather data that we are getting from the Air Force, we have put them into a model, as we call it which we use now to begin to estimate the grain production in the Soviet Union early in the year. It is not an econometric model, it is really a model which is jud gmental. But it does go into fine detail by regions and by crops. An it was obvious to us in the early part of June that from the model just about the same time the spring wheat was being planted that there was going to be a weather problem.

Chairman HUMPHREY. Is this from our weather satellite or from a reconnaissance satellite ?

Mr. BELL. As I understand it, Senator, it is basically from the monitoring—it is two parts. There 1s a regular international exchange of weather data, and, second, there is a monitoring of radio stations by the Air Force themselves, who bring this data together in a computerized system and make the final material available to us.

Chairman Humphrey. Are you using any LANDSAT data?

Mr. BELL. We do have some information that comes to us from ERTS. At this stage it is quite limited, and its usefulness-you are aware, though, of our project we have which we call LACIE, which is using the satellites to try remote sensing. Mr. Hume and Dr. West are going to talk a bit more about that tomorrow.

There is still at this stage a difference of opinion within the Department about the effectiveness of that. I tend to be '(pro" on it. I think that in 4 to 5 years from now, the remote sensing will be very beneficial to us for crop forecasting, not only in the Soviet Union but in other places.

It is interesting, within the past several weeks, there has been an interest on the part of the Soviets themselves to want to cooperate in this effort. And NASA has talked with us in the last couple of weeks about the degree of cooperation on technique, which really is outside of us in the USDA—it is something that they will have to do.

There will be a team here from the Space Institute of the Soviet Union in October to look at some areas and discuss this. So I think that is encouraging, too, that we will be able to get a joint project eventually going in this area.

We do get some limited information from the satellites now that has been helpful, but it certainly is not definitive enough to provide us with the same type of information we get from our analysis of the weather data itself.

Chairman HUIMPHREY. I hope you can encourage the negotiations with the Soviets on space technology that relates to weather information and to the LANDSAT technology.

I think for the record I should say during the time I was chairman of the Space Council, it was the Department of Agriculture and the Department of the Interior that insisted we continue to develop remote technology sensing satellite-now known as LANDSAT.

Mr. Bell. If I might, Mr. Chairman, comment just briefly on your earlier remarks about what we are trying to accomplish in the long-term agreement with the Soviets on gram.

Many of the elements that we are trying to put in the agreement you have already touched upon, and that is that we would like for them to become a regular buyer where they would have spaced purchases and we **would** know in advance, within a range at least! what they intend to buy. And I have hopes that that type of agreement will be worked out and relatively soon.

With respect to your question about participation of firms in the export trade with the Soviet Union, we have urged the Soviet's buyers to try to broaden the number of people that they deal with. We particularly mentioned to them the farmer cooperatives. And we have had some interest on the part of the farmer cooperatives in trying to do business with the exporters who have buying agencies-but, as you have rightfully pointed out, their technique of buying very large quantities makes it very difficult for a co-op who does not have the same type of information-gathering system to compete effectively with the five or six large grain export firms.

Chairman HUMPHREY. And some of the co-ops are not oriented toward direct export. They are the accumulators.

Mr. BELL. That is right. They originate the grain and mak~

Chairman HUMPHREY. They are not in the export business.

Mr. BELL. And then they say they have made an export sale, that usually means that they have made an export sale to *a* ship, to Continental or Louie Dreyfus or someone who ends up making the sale to the foreign country.

Chairman HUMPHREY. The Russians seem to like to do business with the biggest possible firms. They are always talking about monopoly capitalism and they end up aiding and abetting.

Mr. BELL. Again, I think, Mr. Chairman, that that comes about, because of their system where they want to plan far ahead and they want to know what is going to be coming in 3 or 4 months from now and they want it in specifics. They are such a vast country, the quantities are so large-this *is* the system they go to.

At the same time, I appreciate what you said about India, and I also could add Japan. India this past year bought 41/3 million tons of wheat from the United States.

Chairman HUMPHREY. That is commercial sales.

Mr. BELL. There was a little bit of Public Law 480 in there, about half a million tons. The other 4 million tons were commercial purchases.

That in fact also was done through a monoPoly buying agency, known as the Food Corp. of India. And they have a man who is a wheatbuyer located here in Washington in the Indian supply mission. He bougt his 4 to 4.5 million tons on a day-by-day basis as he went through the season. And, as you have rightfully pointed out, by this type of technique, no one said anything about the Indian purchases.

Chairman HUMPHEREY. Most people didn't even know they were buying.

.Mr. BELL and I also would think, from what I know about buYing operations. that he was a very effective buyer. And he probably ended up paying a better price than the Soviets would have done by their swooping technique, as I call it. The Japanese in the case of wheat also have a monopoly buying agency, called the Food Agency, as you are probably familiar with. They 'buy on a tender system. Again, they do not cause the ripples in the marketplace as we do by this rushing in and buying the large quantity all at once that the Soviet Union has used.

Now, we have pointed those examples out to the Soviets within the past several weeks and hopefully we can persuade them that there is some **merit in that** type of buying.

Chairman **HUMPHREY.** I am one that happens to believe that it is important, for us to have this export trade with the Soviet Union. However, the issue is, how do we regularize the trade is the context of an orderly marketing system?

Mr. BELL. The objectives of the long-term *agreement is to embody* the same principles you are talking about.

Chairman HUMPHREY. What kind of information coordipation do you have on an international basis? What information is collected, how reliable is it, and what sources is it obtained from ? Let's take, for example, one crop, wheat, which is always the key crop.

Mr. Bell. We have one prime international source of information on wheat which is probably our best source of information.

Chairman HUMPHREY. London?

Mr. BELL. The International Wheat Council in London. It is by far the most effective international body in the gathering and analyzing and dissemination of information.

Under the current agreement, we have a meeting in London of the 10 major countries where the information is supplied and put together by the staff and a report is distributed to member countries.

And I think it has been very useful in terms of providing a degree of stability to world trading in wheat. When it comes to the other. commodities, like rice and coarse grain and meat, we do not have that effective a system, We do have information which comes from the FAO. in Rome. It tends to be less prompt and it is not, in my judgment, as accurate and as useful as the information coming out of the International Wheat Council-or as up to date as the information from the International Wheat Council. There has been an effort, though, within . the past year to year and a half, mostly as a result of the World Food Conference, I believe, to improve that system. And the FAO staff is putting out a monthly bulletin now on the outlook for grains. We find, of course, that a lot of that is our own information coming back to us. But we do not necessarily quarrel with that if it goes to other countries and it helps in their decisionmaking-we think it is useful.

But the Intonational Wheat Council and the FAO are the two prime sources of data from international organizations.

Chairman HUMPHREY. I have a few questions at this point I would like to ask you.

First, what steps can you tell us are being taken by the administration to have a unified U.S. grain policy? There seems to be so many participants right now, with the USDA, the State Department, the Labor Department, and the special representatives of the White House,

Are we really arriving at a policy or is this just an ad hoc business that we are going through ?

Mr. BELL. We in fact do have what we call an International Food Review Group, which was established b a memorandum issued by Secretary Kissinger following the World Food Conference, which Secretary Kissinger and Secretary Butz are the chairman and vice chairman of.

And under that International Food Review Group, which is at the Cabinet level, we have a working group which is generally chaired by . Tom Enders, Assistant Secretaryof State, which is an effort to try to bring together the views of all the departments on international food polcies. We have worked consistently on that in trying to develop our positions for an international food reserve system, which we finally agreed on here the middle of last week, in order to present it at a meetin in London on Monday.

With respect to the recent events e[illegible] to have been handled more on an ad hoc basis than it has coming through this formalized review group .

Senator KENNEDY. Mr. Chairman?

Chairman HUMPEREY. Yes Senator Kennedy.

Senator KENNEDY. I must leave soon to attend another meeting. There are a couple of areas I would like to cover before leaving.

Chairman HUMPHREY. Please right ahead.

Senator KENNEDY. You may have covered this in your earlier remarks; I regret I was unable to be here.

During a recent meeting of the Joint Economic Committee, Mr. McElvoy was asked what impact the Soviet grain agreement would have on consumers. He responded that he thought the impact would be rather negligible; however Arthur Burns testified to the contrary. When Secretary Butz testified before the Agriculture Committee, his testimony was contrary to Mr. Burns.

The President stated last week that he thought the agreement itself would be in the interest of both consumers and producers. I wonder if you can clarify what the basis of the President's remarks was and how the agreement will be in the interest of consumers.

Mr. BELL. Fine, Senator. If I might go back and scenarios which took place regarding the comments by C airman Burns and subsequent Secretary Butzo. Several month ago, when we had the first sales of about 10 million tons of grain to the U.S.S.R., the U.S. Department of Agriculture at that time estimated that 10 million tons would perhaps raise the price of food at retail about 1 to 11/2 percent.

Subsequently, Chairman Burns testified that the sales of grain to the Soviet Union during the entire year would raise the cost of food about 2 percent.

From those two figures, there seems to be an inconsistency where in fact there is not. In the calculations by the Federal Reserve Board, they took into account probably further sales. Our calculations did not take into account, except where we had sold—

Senator KENNEDY. Is this a total increase of 2 percent in terms of the Consumer Price Index ?

Mr. BeLL. It is the food component of the consumer price index and the food component makes up about 20 percent of the CPI.

Senator KENNEDY. But just this one deal amounts to anywhere from a n/2 to 2 percent increase in the cost of food?

Mr. BELL. The 10 million tons that we have sold and reported to date, we estimate will increase the retail price of food by 1 to l1/2 percent. Further sales which will be made will probably raise it another half a percent, which is a total maybe of 2 percent, resulting from sales which we probably will make during the course of the 1975 to 1976 crop year.

Now, you ask how do we view that as being in the interest of consumers. I, for one, look upon the Soviet Union now as being a regular buyer of grain and other products from the United States. We have been selling grain to the Soviets every year since 1971. Our real problem with the Soviets is their buying *pattern.* They have bought large amounts one year, small amounts the next year, large amount% the next year, small amounts the following year. This has tended to add a degree of instability to the market.

And the purpose of the long-term agreement we are now discussing with them is to try to smooth out that buying pattern and bring more stability to the market.

But, Senator Kennedy, we must have the Soviet market if we are going to continue to run American agriculture at full capacity. We still have more resources available to us under our system of agriculture than we can adequately use to feed our own people and generally Western allies and the developing countries.

So I think the main benefit we get from selling grain to the Soviet Union is that we run American agriculture at full capacity. In the longer term, that means lower food prices for everyone.

Senator KENNEDY. Yet in the immediate term it results in a 2 percent price increase.

Mr. BELL. That is right. In the short term, there maybe some higher food prices than there would have been without the sales, but in the longer term it is our feeling that it will mean lower food prices.

Senator KENNEDY. How much do you anticipate selling to the Soviet Union over a longer period!

Mr. BELL. I look upon the Soviet Union to be a market on a yearly basis of around 8 million tons a year, including about 5 million tons of feed grains and three million tons of wheat.

And if you look at the figures over the past several yearn, we have averaged selling them about 6 to 7 million tons, and from all countries they have purchased about 11. I would see that continuing to be a factor in the market.

Senator KENNEDY. What is going to be the impact over the next 3 years in terms of increased costs to American consumers? When does your curve turn around ?

Mr. BELL. I would say that it will begin to turn around by 1977 to 1978. Without. the Soviet market, I would think that by 1977 or 1978 we would be back into what we call the land set-aside program, we would be asking the farmers to restrict production, which in turn eventually means higher prices for food.

Senator KENNEDY. Is this based upon what your understanding of what production would be over any period of time ?

Mr. BELL. Yes; it is.

Senator KENNEDY. It seems to me that there has been, quite frankly, a woeful lack of accuracy in agricultural projections. To a great extent this is due to a lot of different factors which people don't have any control over. In view of this lack of accuracy, I am interested in how you am able to make these projections that you have been discussing with such certainty.

Mr. BELL Senator, that if you go back and study our record in the longer term sense, that our record is fairly good. Our difficulty has been in the current l-year forecast, where the weather factor comes into effect and is much more difficult to deal with.

In our new projections which we have made, I would like to say that we have taken into account *some* new factors, which we think will put a restraint on the increasing of American agricultural production in the years ahead.

I think the increments in productivity that we have had in agriculture will be more difficult as we move into the next 4 to 5 years for a, number of factors, One of those being of course, the higher cost of energy, which is very important to farming, the higher cost of energy - related fertilizer, which again is important, and then just the cost of machinery which is involved in mechanization and the cost of credit. All of these, I think, would tend to slow us down in the gains which we have had during the past 15 years, but I am confident that there will be gains and that we will continue to increase our production, with a lot of the increase going into the export market.

Senator KENNEDY. I have to leave in a moment. May I ask just one final question? Why is there such variation between the information that we have on the Soviet Union from the Central Intelligence Agency and that from the Department of Agriculture ?

I don't know what the chairman's experience has been, but, when you ask Soviet officials to provide information about their grain production, they say, "Well, you have your satellites, which take pictures of our agricultural areas. These satellites can pinpoint exactly what our production is. Why do. you people make such a big point about making these statistics public ?"

Then when we have the difference in the figures that are reported by the Department of Agriculture and those reported by the Central Intelligence Agency, how do you explain the discrepancy? Are we using the satellite ? Are we getting accurate information? If we are, why the difference between the two agencies?

Mr. BELL. The data which is used to make the various estimates among the various Government agencies are basically the same data, and it is basically the weather data which I guess I discussed before you came in.

There is a judgement factor involved in making those estimates. And at times there can be wide variances in the judgment—

Senator KENNEDY. Why is it just weather data? Why aren't satellites used to photograph the crops to give us better production estimates ?

Mr. BELL. The Soviet Union becomes much more hazardous in terms of trying to estimate than our own country, because of where it is geographically located. It is so much farther north, the season is muchs shorter, it is very subject to change very quickly.

And this is true also in the case of the northern Great Plains region, it is also very true in the case of Canada. If you go back and follow the Canadian crop estimating and their a-merit of the crop, they are much more uncertain about the size of them crop right into the very end than we are in the United States, where we are much more southerly located and we have a much broader production pattern.

We are using the satellites to give us information on the Soviet crop situation. At this stage, the usefulness is quite limited.

We do have a rather large-scale project which we initiated last year with NASA, which is about a 3-year project, and I believe that at the end of the 3 years that it will probably turn out to be very useful. But we are going to have to run through the series.

And, as I was telling Senator Humphrey before you came in, here within the past several weeks we have had some interest on the part of the Soviets themselves in cooperating with us on that type of project. And NASA has a team coming into the United States at the end of" October to discuss about the techniques of what is called remote sensing, which is the use of the satellite.

Chairman HUMPHREY. Isn't it a fact that about 90 percent of the arable land in the Soviet Union is north of Minneapolis ?

Mr. BELL. Yes; that is true.

Chairman HUMPHREY. That means the variation in temperature in this part of the Soviet Union is significant.

Senator KENNEDY. Thank you, Mr. Chairman.

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Chairman HUMPHREY. About 2 years ago the temperature in Minnesota dropped down to 23 degrees-a sharp frost--in late August. This August It was as high as 95 degrees. Trying to predict frosts in these northern climates depends 98 percent on good luck.

Secretary BELL. I have just a few more observations.

I notice in the Wall Street Journal yesterday that further sales of U.S. grain to Poland have been suspended until the United States concludes negotiations on a long-term grain sale agreement with the Soviet Union.

Isn't this just another example of where a bilateral arrangement with one country such as the Soviet Union tends to disrupt the pattern of sales with another country? We have been selling to Poland quite regularly over the years.

Mr. BELL. Since the end of World War II.

Chairman HUMPHREY. They have been a good long-term customer. "

Mr. BELL. We in fact, Mr. Chairman, have an agricultural a - ment with Poland for the exchange of information. And the roles have been very good in terms of providing the data that they have been asked. They in fact have been giving us before the beginning of the season a general idea about what their import requirement is going to be by the type of commodity, and they have pretty well stayed with that.

What hapened to them this year is thattheynormally depend upon the U.S.S.R. to supply them about 2 million tons. Around early August, they were told, by the Soviets that they would not get an from the U.S.S.R. and they should be on their own. And the Polish officials, if I may say so, faithfully reported that to us under the terms of the agreement, and that they would be buying more and that they hoped that they could,

I, in fact, told the Polish officials that we had expected that would generally happen when the Soviets were short and that we had no problem meeting their requirements. So I was a bit taken by surpise when the State Department approached them and asked them to delay their purchases for awhile. Because in m judgment they in fact were doing a very orderly job of buying in tie market; they had kept us posted generally about what they intended to do; and it was coming into the reporting system, as it should have.

Chairman HUMPHREY. So they were cooperating in terms of providin information.

Mr. BELL. All the way.

Chairman HUMPHREY. From planting intentions to predictions, crop , estimates to the consumption or use of grains?

Mr. BELL. The had basically been sup lying us the data that we asked for under the Soviet agreement but had not been able to get-forward estimates and trade estimates.

We also completed an arrangement like this with Romania a week ago last Friday. And it will provide the same type of information. Romania becomes interesting to us in that it is one of the countries in Eastern Europe that moves from year to year from an exporter to an importer. And that can affect the trade between regions. Hopefully we can be as successful with the Romanians as we have with the Poles. If we are, then we will feel pretty good about it.

We still have some holes in our information system in Eastern Europe, particularly with East Germany. we have just recently established relationship with East Germany. We are just now beginning to find out who the key people are and beginning to meet them. Hopefully, that's-we will be able to-

Chairman HUMPHREY. They are already buying from our markets.

Mr. BELL. In fact they have been a much larger buyer than have the Poles. As of the middle of last week, our reporting system showed that we had sold Eastern Europe about 4.7 million tons of grain, including about 2 million to Poland and about 2.3 to East Germany and the remainder, 300,000 to 400,000 tons, to Romania.

Chairman HUMPHREY. And those are in smaller sales; aren't they?

Mr. BELL. That's right.

Chairman HUMPHREY. They are not in big lump sum sales.

Mr. BELL. Right.

Many of the purchases by Poland in fact were of the 50,000-ton size or less and did not even show up in the daily reporting requirement that we have in which we have to report sales of 100,000 tons in a week. The came in the weekly report.

Chairman HUMPHREY. What I am trying to emphasize for the record is that approximately 4½ million tons has been purchased, and the media has hardly mentioned it.

Mr. BELL. That's right.

Chairman HUMPHREY. It has only been noted in the professional agricultural journals. But when the Soviets make a 3-million-ton purchase at one time, it is like falling off the ledge of the Grand Canyon. Right away someone says a major decision is being made.

Let me ask you *one* other question. If we maintain this hold on exports to the Soviet union, is there any reason that the Dutch can't buy from us and transship?

Mr. BELL. There is no reason that they couldn't. I look upon it as highly unlikely. It would have to be done through transshipment out of Rotterdam in what we call coasters.

Chairman HUMPHREY. That's what I mean.

Mr. BELL. Again, the Soviets generally have not been interested in that type of trade.

Chairman HUMPHREY. But let's say for example that they must get the commodity. The Russians are not buying from us because suddenly they decide that Bell and Humphrey are two of their best friends. They are buying because they need it.

If we persist in holding back exports to the Russians, isn't it likely that they will be able to buy through the Dutch or another count .

Mr. BELL. I have looked at this question, of course, Senator Humphrey. In my judgment, the transshipment capabilities of the Soviet Union out of the Rotterdam-Antwerp-Amsterdam area is quite limited. That is very much a part of the West European trading system. Most of the grain which goes into the United Kingdom now comes through the transshipment business. It would be impossible for very large quantities to be transshipped into the Soviet Union out of that-

Chairman HUMPHREY. What about the possibility of rail shipments across and out of France.

Mr. BELL. There are two things that prevent that from happening. The Soviet canal system does not interlock with the East European-West European system, and the railways in the U.S.S.R. are a different size gage than they are in Eastern Europe and into Western Europe. We have looked at this question in respect to the possible transshipment of purchases from the East European satellite countries into the U.S.S.R. and are confident that that is not being done.

I do think, though, that in terms of the hold that we have at the present time on sales, that in time that the Soviets would be able to meet their requirements by buying the Argentine spring 1976 corn crop, sorghum crop; there will be sorghum from Australia at that time. There will be other supplies which eventually can fill the gap if our hold continues.

Chairman HUMPHREY. Right. That's what my farmers say.

Mr. BELL. And what will happen is that we will end up then supplying the grain probably to the other markets in larger quantities than we normally would. S0 the hold, in terms of insulating ourselves in the market. really doesn't do that much. The purpose of the hold is to try to give us time to work out a system which will have a more adequate framework in which to deal in the future. And if I understood what you said, you concur in that attempt.

Chairman HUMPHREY. The reason I mention this is because of a commodity news service report that says the following:

Although U.S. grain export firm representatives recently have. been shuttling in and out of MOSCOW, none has notified the Agriculture Department of serious negotiations for the sale of more U.S. grain to the USSR. Assistant Agriculture Secretary Richard Bell said at the weekend that he is aware that a number of export representatives visited Moscow recently and may be there now, but indicated he is confident none is trying to sell U.S. grain to the USSR while such sales are prohibited.

You don't think they are just over there for a visit, to look at the walls of the Kremlin ?

Mr. BELL. In fact, they are attempting to sell other origins.

There is no difference between the American export firms and the international trade firms. They are all the same. And they have been into Moscow lately selling Argentine, Brazilian, Eastern Canadian grain. And that's what they have basically been working on.

Chairman HUMPHREY. So what they are really doing is selling other countries' grain to the Soviet Union, even though they may be multinational American companies?

Mr. BELL. That's right.

Chairman HUMPHREY. Is it not possible that, as in the past, we always have a certain number of export sales of uncertain destination.

Mr. BELL. It would be unknown destination.

Chairman HUMPHREY. These American multinational firms export American wheat to another exporting country, which becomes a foreign exporter as far as we are concerned, and the-y in turn export American wheat directly to the Soviet Union.

Mr. BELL. Now, we have-within the reporting system at the present time, Senator Humphrey, the reported sales to unknown destinations are not large. We have though taken—

(Chairm HUMPHREY. That's what I said. This practice was much more than a year ago.

Mr. BELT.. And we have taken the precaution, though, of not only talking with the export, firms about this question. But we have used our audit authority under the act to make audits of the records of the companies on which the reports are based. And we are satisfied that there is not, any business going on which *is* inconsistent with the request we have made to them.

Most of their activity, in other words, has been related to the selling of other origins.

(Chariman HUMPHREY. Of other origins?

Mr. BELL. Yes, sir.

Chairman HUMPHREY. Is it not possible that an importing country becomes accustomed to buying from other origins? We always used to say in Humphrey's Drug Store that if we could get a customer from one of our competitors just once, we would have a chance to hold him for a while.

Mr. BELL. I think that's true. that one of the ways of building markets and maintaining them is being a reliable, steady supplier; and that once you have worked and built the market and then you are out of it for awhile, and the new one who moves in has a much-an advantage over you.

It is my feeling though at the present time, despite the problems we have had on the grain standards and the grading, that when it comes to quality, that the Soviet buyers would prefer our grains over the other origins, and that although the contracts today may be made for Argentine corn, as we go later in the year, there could be amendments to those contracts where perhaps our corn would be used. You can't tell at this stage.

(Chairman HUMPHREY. I think that's basically true. But I am a suspicious fellow—not of you, sir—but, in this competitive world where there is a dwindling supply, I think that every time we lose a market, we lose a chance.

Mr. BELL. I agree with you.

Chairman HUMPHREY. What concerns me is the disruption of the marketing system.

What is tile world grain supply situation this year as compared to last year and the year before?

Mr. BELL. Looking into the 1975-76 season, a few months ago, we thought we were going to have quite a bit more grain from our 1975 crops and that we would actually build stocks 'during the 1975-76 Season .

At the present t i me, I do not think that there will be much of it built up in the world stocks at all.

(Chairnman HUMPHREY. Will there be less ?

Mr. BELL. I think we will end up about where we are now. There may be some modest buildup. I think that the buildup that does occur will be in the coarse grains or the feed grains area; and this is basically-we still have problems with the European and Japanese economy not quite recovering to the degree that they are using as much grain for animal feeding as they were a few years ago.

I look upon the wheat market though as being more potentially tight: that is milch more finely in balance. And I believe at the present time that we will have a world wheat stocks (decline in the 1975-76 season: but, we in the United States will go up because our size or crop being so much larger than-

Chairman HUMPHRRY. The recession has in a sense dampened some of the consumption, hasn't it ?

Mr. BELL. It has dampened consumption in the European community and in Japan, maybe by as much as 3 to 4 percent, or maybe 5 percent; but it has certainly not dampened the usage of feed to the same degree as it (did in the United States. This in part is related to the types of livestock economies they have. In the case of Japan, two-thirds of the grain is still fed to poultry, and you can't put the poultry out on grass.

Chairman HUMPHREY. They don't have much grass for their cattle.. .

Mr. BELL. Right.

Chairman HUMPHREY. We can put them out on grass and feed them much longer.

This is such a complex subject. For example, consider the problem of accurately forecasting weather. Now, using scientific analysis, we are able to monitor the weather pretty well. But I am a South Dakota boy originally, and I remember those good crops we used to have in July that were not worth much in August.

Mr. BELL. Right.

Chairman HUMPHREY. We would have 2 weeks of blistering sunshine and drought, and all would be lost. When the Russians in 1972 had a bad crop, it was those July and August winds and drought that destroyed it.

Mr. BELL. The deterioration in the case of 1972 in the Soviet Union occurred almost within a 4-week period.

Chairman HUMPHREY. That's right. I lived there about 6 or years and we never had a crop from 1929 to 1937. I remember it always looked good in June. We used to lookup in the sky and see those great big clouds and my father said, "Son, there's nothing in those; those are empties coming back."

In those days, we used to have reusable bottles, you know.

In the Polish situation, do you have maximum and minimum trade targets on the grain?

Mr. BELL. We have a spread; yes, it is a range.

Chairman HUMPHREY. So you have an agreement, an understanding?

Mr. BELL. Yes; we do. We have an agreement for the exchange of" information and then we have some generally agreed targets spread . over a 3-year period.

Chairman HUMPHREY. I understand that your department gets information regularly from the CIA, is that true?

Mr. BELL. Yes, sir.

Chairman HUMPHREY. Do you think there would be any chance that we could get this information on a timely basis ?

Mr. BELL. It is my understanding that Members of Congress who ask for it receive their finished product.

Chairman HUMPREY. Do we get that ?

Mr. THORTON. Yes, 1 believe we do, sir.

Chairman HUMPHREY. We have been getting it ?

Mr. THORNTON. Yes, sir.

Chairman HUMPHREY. Do we get it regularly ?

Mr. THORNTON. Well, we have to take the initiative.

Chairman HUMPHREY. Why don't we just get this information on a regular basis?

Mr. THORNTON. Well, they handle it rather sporadically.

Chairman HUMPHREY. Just a few more questions.

These agreements we are working on, such as the Soviet agreement, may provide U.S. grain producers with a degree of price stability and price support, actually—

Mr. BELL. Hopefully, sir.

Chairman HUMPRHEY. During periods of abundant production.

But how do such agreements provide, any supply or price protection for U.S. buyers, such as livestock producers, consumers, or other foreign buyers, with whom we have not signed an agreement, during periods of short supply?

Mr. BELL. Part of the theory behind the Soviet long-term agreement is that they would couple, the Soviets, their purchases, their regular purchases from us, with a more effective storage system on their own.

As you know, in 1973, they had a very large crop in the Soviet Union but in fact we estimate they have lost somewhere around 35 million tons of that because they were unable to store it.

Chairman HUMPHREY. I know it.

Mr. BELL. And they do have plans in the current new—in the draft 5-year plan for 1976-80, to construct about 40 million tons of storage capacity. That seems very ambitious. If they can just do part of that, I think it will be helpful.

We do hope though that they will couple their regular purchase program by a more effective storage program so that when they run into a situation like they have in 1975, that they can destock some and continue to buy the regular amount from us And by doing that, we feel that it will bring a degree of stability to our domestic livestock economy and also will add a degree of certainty to our other traditional buyers like the Japanese, the West Europeans, and so forth.

Chairman HUMPHREY. I want to say I noticed we have been selling off most of our bins.

Mr. BELL. We have sold off the bins from the government; but the bins in fact are still out there, sir.

Chairman HUMPHREY. We haven't sold them ?

Mr. BELL. We have about-well, not all of them.

We have about 300 million tons of storage capacity here in the United States.

Chairman HUMPHREY. We do?

Mr. BELL. And—

Chairman HUMPHREY. You mean available now with the terminals ?

Mr. BELL. We have 300 million tons of storage capacity, half on farms and about half off farms; and in a good year, we would produce somewhere around 290 to 300 million tons of grains and oil seeds.

Chairman HUMPHREY. So we have a storage capacity equal to a good year's crop?

Mr. BELL. That's right. A little bit above that.

Chairman HUMPHREY. Well, that's very good information.

What worries me is that in a very real sense we have so politicized, so traumatized these sales, that it is causing a range of reactions.

For example, what's the price of spring wheat now?

Mr. BELL. Spring wheat would be around-

Chairman HUMPHREY. $4.50.

Mr. BELL. Yes. I was going to say $4.40.

Chairman HUMPHREY. $4.40, $4.50, depending on grade.

Mr. BELL. That's right. And the protein is very low this year, and so it's—

Chairman HUMPHREY. It is down some.

Mr. BELL. Yes. Almost everything is sold on a protein basis.

Chairman HUMPHREY. About a year ago, around the 5th of September, wheat was about $5 a bushel.

Mr. BELL. Yes, sir. It's about 50 cents lower today.

Chairman HUMPHREY. Now, that $5 wheat of a year ago went down in February to about $3.70.

Mr. BELL. That's right.

Chairman HUMPHREY. Isn't that correct?

Mr. BELL. That's right; $3.70, $3.75.

Chairman HUMPHREY. During that period of time the price of bread went up 9 percent. Why can't we get that information out? Here wheat is going down from $5 to $3.70, and in that same period of time, the price of bread in the market went up approximately 9 percent a loaf.

Farmers that had to sell wheat at $3.70, won't get rich. Now the price of wheat is up to $4.50—it varies between $4.35 and $4.60, depending on grade. And everyone is talking about how inflationary that is.

Mr. BELL. That's exactly right.

Chairman HUMPHREY. But we can't get that message across. I think one of the reasons we can't is that the President and the Secretary of State have been scared out of the export business. Now. you don't have to respond to that, because I know what your position is.

Mr. BELL. Thank you.

Chairman HUMPHREY. Just another question.

How did Secreatary Butz learn of the Soviets' grain-buying plans in July? Did a senior U.S. official ask Soviet officials regarding their grain import plans when rumors of such buying plans were reported in the news?

Mr. BELL. Well, basically from two sources.

As I had said earlier, we had watched the Soviet crop situation from the beginning of the spring and were aware that deterioration was setting in in the Volga Valley and in that general region.

At the same time we were aware that they did not have a very large crop last year and that they actually were below their procurement target, which meant that they were probably going to be short if they did not meet the plan.

our first information, though, regarding the Soviet purchase intentions, in fact, came to us through the export firms.

The export firms for the past year have been almost in constant contact with the Soviet buyers; and they go in and out of Moscow almost weekly, and there is someone there generally every day.

We have asked them to keep us posted on the Soviet attitudes and information. They have done a good job of doing that. They have generally given us a report on every trip in and every trip out and in June, they began to tell us that they felt the Soviets were showing an interest and were probably going to buy. Not until the first week in July did we get a call from one of the export firms, who said that they felt that they had in their sense opened negotiations for the sale of grain to the Soviet Union. Whithin the same day we got a second call.

Chairman HUMPHREY. About the 10th or llth of Jul y, around there?

Mr. BELL. Yes, sir.

And at that stage, they kept us informed of the quantities they were talking about; each firm told us the quantities they were working on; we kept that information generally to ourselves about what each company was doing, but if you go back and follow the information put out by the Department, you will find Secretary Butz in the early part of July talking about potential sales of 5 or 10 million tons.

Chairman HUMPHREY. That is correct.

Mr. BELL. And then when we got to the 10-million-ton sales level, the next step was, we asked-we felt that we were getting into an area which was more slippery, and we asked that they begin to contact us before they began what we considered negotiations. And in fact as you know there have not been any sales since that time.

Chairman HUMPHREY. Do the agricultural representatives plan to include a provision in the long-term grain purchase agreement now being negotiated to require Soviet authorities to notify our Government of the quantity of purchases planned for the current marketing year in advance of negotiations with private grain companies?

Mr. BeLL. Yes; first, of all, I think that there will be a general range that they will buy within each year. If they are going to go above the top of that range, then they would be required to consult with us at the government level before they move ahead.

We have also-we are intending to include in the agreement a section requiring advance information. I'll be quite frank with you though, Senator Humphrey. I have not much more hope of getting any more information out of that section than we do out of the current agricultural agreement. I think that the safety features are really in fact—is this range, and then their having to come to us before they go above it.

Chairman HUMPHREY. Be persistent in trying to get that information. It takes time.

You have talked to the Soviets you say about their distributing purchases throughout the marketing year—

Mr. BELL. Yes, sir.

Chairman HUMPHREY. And the Soviet weather bureau service is considered *one* of the best in the world, from what I understand.

Mr. **BELL. As far as we can tell, it's always accurate and very much on-**

Chairman **HUMPHREY. Do** we get information regularly on this?

Mr. BELL. Yes; we do. We actually get it through the NOAA. You can call NOAA at any time and get a fairly current report on the weather situation in the U.S.S.R.

Chairman HUMPHREY. Do we have information as to how they use that weather information in their agricultural planning? Do they produce long-range forecasts that they rely on?

Mr. BELL. We find that they actually have a very detailed system of long-range weather forecasting. We have been told by them it is correct about one-third of the time.

Chairman HUMPHREY. Have we ever thought about the feasibility of a cooperative research project with Soviet scientists for the development of regional models, regional crop yields, based on weather information?

Mr. BELL. Yes; we have. We actually have a project under the exchange agreement called forecasting; and this is-we have had one workshop on that with them and we intend to do further work in this general area.

Chairman HUMPHREY. Now, the United States has a trade target agreement with Japan, sort of a gentleman's agreement, as I understand it.

Mr. BELL. Best endeavor efforts, I call it.

Chairman HUMPHREY. Is it siged? Is it a formal document!

Mr. BELL. We have a press release and they have what they call a communique.

Chairman HUMPHREY. Now we have one being negotiated with the . Soviets which will formally commit the United States to a long-term supply agreement totaling approximately 25 million tons of grain, or about one-third of our grain exports; is that correct?

Mr. BELL. Well, we are talking, sir, in the Soviet agreement of somewhere between five and eight.

Chairman HUMPHREY. Five and eight per year?

Mr. BELL. Which would be around 10 percent of our annual exports of grain, which is around—

Chairman HUMPHREY. How many million tons do the Japanese import ?

Mr. BELL. The Japanese requirement is 14 million tons, including 11 of grain and 3 million of—

Chairman HUMPHREY. That equals between 22 and 24 million tons between the two.

Mr. BELL. And our West European exports in fact are up around 15 to 20 million tons. Again, you never hear anything about that.

Chain-mm HUMPHREY. That's right. How formally binding are these agreements ?

Mr. BELL. Well, the one with the Japanese, as I have said, is the best endeavors. It in fact is not a binding agreement. I think in the case of the Soviet Union, it will probably be a more formal agreement and there will be a degree of binding commitment. How much, I think, we don't know at this stage.

Chairman HUMPHREY. Do you think other potential importers will seek similar agreements ?

Mr. BELL. Yes; I do. We have already had a number of countries which have come to see us in the past several days asking when they can begin negotiations for their long-term agreements. Most of the countries that have come have been from the Western world and we in fact have told them, you know, that we don't really see a need for this with everyone. We do want to develop a system for the exchange of information; that we still believe in the multilateral world, not a bilateral world.; the Soviet Union is unique; it is vast; it has concentrated purchasing power; they are not members of the general agreement on tariffs and trade; they are not living by the same trading rules, and so we think there needs to be something different there, but not, with everyone eke.

Chairman HUMPHREY. Are they a member of the International Wheat Council ?

Mr. BELL. They are a member of the International Wheat Council.

Chairman HUMPHREY. Is the People's Republic of China?

Mr. BELL. China is not. We would hope under the new agreement that they might be.

Chairman HUMPHREY. Is there any chance that we can establish an exchange of information programs with the Chinese?

Mr. BELL. I think it would be very limited. I remember very well, Mr. Chairman, the discussion of this issue at the World Food Conference; and the Chinese said time after time that they looked upon the providing of this information as an infringement on their sovereignty.

Chairman HUMPHREY. I remember that.

Mr. BELL. And that they were not going to participate.

Chairman HUMPHREY. Of course, you never know when people will change their minds.

Mr. BELL. Right.

Chairman HUMPHREY. What safeguards have you instituted to assure that such agreements are not destabilizing in years when U.S. crop yields are unfavorable?

Mr. BELL. In the Soviet agreement, sir, we are intending to have what we call an escape clause mechanism which would provide for consultations to perhaps limit the purchases in the case of a short crop here in the United States or elsewhere. We have a safeguard clause.

Chairman HUMPHREY. Thank you very much for your comments, Mr. Secretary.

[The prepared statement of Secretary Bell follows:]

STATEMENT OF RICHARD E. BELL, ASSISTANT SECRETARY OF AGRICULTURE FOR INTERNATIONAL AFFAIRS AND COMMODITY PROGRAMS, U.S. DEPARTMENT OF AGRICULTURE

Mr. Chairman, I appreciate the opportunity to appear before the Technology Assessment Board—and to discuss efforts being made to improve the data going into our analysis of agriculture in the Soviet Union.

Since the Board also expressed interest in information exchange between our country and the People's Republic of China, let me say that this exchange is very limited. We have no formal arrangement to exchange production data with the PRC. There is, of course, the exchange of library materials and a limited exchange of agricultural teams and technicians.

For example, the Agricultural Officer at the U.S. Consulate in Hong Kong visited the People's Republic in the fall of 1974, and this was very useful. This Agricultural Officer and his assistant are both Chinese specialists, fluent in the language, and Hong Kong is an important listening post for us.

We also receive information through the U.S. Liaison Office in Peking, although we do not have an agricultural officer in that mission. We hope that our formal reporting of agricultural and trade data from the PRC can be strengthened in the near future through addition of an Agricultural Officer there.

We have in recent times been able to improve the Department of Agriculture's analysis of agricultural conditions in the USSR. This improvement is the result of two inclusions-data provided by the Soviets under the June 1973 Agreement on Agricultural Cooperation, and increased use of corroborative data from other sources, in particular U.S. programs to gather weather data.

In the past, USDA analysis of Soviet agricultural conditions, as for other nations, relied most heavily on reporting from the U.S. agricultural attache, reports from Soviet and other press outlets on agriculture, and publications provided by the foreign government. While these steps continue to play an important role, progress with the Soviets since 1973 is enabling the United States to obtain some information more quickly, and to expand our data bases. There remain, however, some areas in our analytical work, particularly in forward forecasting, where we have not been able to implement the cooperation with Soviet officials which we desire.

The June 1973 Agreement on Agricultural Cooperation between the United States and USSR calls for the following:

"Regular exchange of relevant information, including forward estimates, on production, consumption, demand, and trade of major agricultural commodities."

The exchange of data is one of the activities under the Economic Information project, which was one of three (now four) established in November 1973 under the Joint Working Group on Agricultural Economic Research and Information. In November 1973, the USSR agreed to provide to the United State 10 categories of data on a regular reporting schedule. Additional requests for data *were* made at the *May* 1974 Working Group meeting and the Soviets responded by providing a reporting schedule for 8 categories of data at the October 1974 meeting.

On the whole, the Soviets have followed the reporting schedule rather closely for the initial 10 categories of data. Allowance must be made, of course, for delays in transmittal. The first-of-month livestock count, for example, which the Soviets have agreed to provide at mid-month, typically arrives in the USDA analysts' offices during the first week of the following month. The usefulness of new data series has been limited in several instances because the Soviets frequently have not provided historical data in the series. In addition, there has been some feeling that the Soviet data are less detailed than was expected. More detailed data were shown to the U.S. delegation at the November 1973 Working Group meeting. The data that have been provided, however, technically appear to meet the specifications of the written reporting schedule that was included in the appendix to the protocol of that meeting.

Data received under the Agreement generally make a contribution in one of three categories. The first. is quicker access to data on actual values (but not forward estimates) of commodity production or related information for the current or most recent year. For example, detailed crop production statistics are made available in February, whereas official publication generally does not occur before April. Likewise, monthly production and inventory data for livestock and poultry on state and collective farms enable a more frequent assessment of output possibilities in the food industry and in the livestock sector. Quicker access to data is helpful in the compilation of periodic statistical reports by USDA and research is facilitated by the rapid availability of data (as opposed to unofficial estimates) on production and utilization.

The second contribution is the receipt of some data not previously published on a systematic basis by the USSR. The reporting schedule provided by the Soviets in October 1974, in particular, contains several instances of new types of data. These include, for example, numbers of livestock slaughtered, oil meal production, and fertilizer use by major crops. These data will be quite useful in long-term quantitative research on the Soviet feed-livestock economy.

A third but—at this point—lesser contribution of the data is information of a very current nature that will enable a better assessment of foreign trade prospects in grains and feeds. These data now essentially are limited to the sown area statistics provided in August, which make a small contribution to current estimates on the supply side, and to the monthly data on collective and state farm livestock inventories, which make some contribution to evaluations of current feed demand.

Despite the relatively good performance of the Soviets in providing data in those categories for which a program has been worked out to implement provisions of the Agreement, there has been 1ittle progress in acquiring data to enable an improved assessment of current production and foreign trade prospects. The Soviets have not yet demonstrated willingness to implement the forward estimates provision of the Agreement. Efforts by the United States to attain implementation of this provision, on the whole, have thus far not been successful in attaining either the forward estimates or a schedule for their future supply. Efforts are continuing, Data acquired under the agreement probably will continue to make only a marginal contribution to current situation and outlook work on grains and feeds until a program is worked out to implement the provision of forward estimates.

Aside from the data requests, some additional progress has been made in the exchange of economic information under the Agreement. In 1975, three separate U.S. teams visited the USSR to tour growing areas and analyze production conditions for winter wheat, spring wheat, and sunflower. In addition, a U.S. team on livestoek and feed use went to the Soviet Union in early 1975. Although these teams had some itinerary difficulties, their acceptance was a considerable improvement over the one such team (winter wheat.) in 1974. These teams facilitate, but are not adequate for, estimates of Soviet crops.

Also, the Soviets have begun to accept the idea of regular bilateral discussions of agricultural production and trade at meetings under the Agreement, although Soviet presentations rarely have included outlook information. Perhaps most important, the range of contacts with Soviet officials in a wide variety of organizations dealing with agriculture has increased greatly under the current Agreement. The development of these relationships throughout the Soviet Government could eventually lead to a much wider exchange of information.

Inter-agency cooperation in the U.S. Government also makes an important contribution to USDA analysis of the Soviet situation. A prime example is in the gathering and application of weather data both to confirm Soviet reports and to assist in estimates of current Soviet crop prospects.

Weather data are used extensively in making forecasts of Soviet grain production. The principal source of weather data used by Soviet analysts in the Department of Agriculture is the Air Force Environmental Technical Application Center (ETAC). ETAC computerizes and processes raw weather data and provides average information on 27 regions within the USSR on precipitation (absolute and percent of average), temperature (absolute and departure from average), and calculated soil moisture (absolute and percent of average). Data are summarized and made available each 10 days, with the data generally avaliable within 5 days at the end of the period, In addition, cumulative monthly and seasonal averages also are provided.

The ETAC weather data are supplemented by other sources. For example, more current, but less processed weather information is available daily through NOAA facilities. This information is checked to supplement ETAC data at critical stages of Soviet crop development.

The Soviets also publish 10 day weather and crop reports in their daily agricultural newspaper. The information in these reports generally is available in Washington within not more than one week of the end of the reporting period. The Soviet weather and crop reports are very selective in regional coverage, contain few data, and do not give crop forecasts. However, they are of some use in evaluating the stage of crop development and the probable impact of varying weather conditions on crops.

Reserchers in tile Department of Agricu1ture evaluate the weather data to estimate regional weather indexes of grain crops. These weather indexes are weighted by the regional area distribution and multiplied by trend yields of individual grains to estimate national grain yields. While results of statistical models are considered in constructing the regional weather indexes the indexes largely are judgmental. All other available information, however, is considered in the process of reaching these regional judgments. Although other information, such as Soviet press commentary on local grain conditions, is important, the weather data are by far the most important source of information used in making Soviet grain forecasts as the crop progresses.

In addition to improving the quality of data available to us on the Soviet Union, we have considerably strengthened our analysis of the data. This analysis, particulary crucial in this year of expanded Soviet import needs, has been helped a great deal by the work of an interagency task force, which we established in early 1973.

This task force on Soviet agriculture has provided a means of coordinating information on the Soviet Union and making this information public on a prompt and systenmatic basis. It includes representatives of four USDA agencies—the Foreign Agricultural Service, the Economic Research Service, the Agricultural Marketing Service, and the Agricultural Stabilization and Conservation Service. During the principal production and marketing season, it meets every two weeks under the chairmanship of the Director of the FAS Grain and Feed division.

Discussions within the Task Force have brought together information which has provided the basis for policy decisions within the Government this year, relative to the Soviet trade. It was this group that first alerted people within Government to the drought developing in the Soviet spring grain areas this year-and then made this information public in a series of reports and releases.

As a result of the work of the Task Force, we believed quite early that the Soviets' 1975 grain production would frill below their goal of 21.5.7 million tons. In mid-April, about the time spring grains were being planted in the Soviet Union, we projected the total 1975 grain crop of the Soviet Union at 210 million tons. Then, as crops were affected by hot weather and drought in major producing areas east of the Volga, we progressively lowered that estimate.

On June 9, we dropped the estimate to 200 million tons. And as the crop situation continued to decline, we reduced our estimate on July 9, again on July 24, and again on August 11. Our current estimate of 175 million tons was made on August 29. All of these estimates were immediately made public.

I should make the point that in the USSR—unlike the United States-spring grains make up from ‘two-thirds to three-fourths of total grain production in most years. Continuous and careful evaluation is necessary though the summer and early fall, in order to keep us on top of the total grain situation. I believe that the Department of Agriculture has done an extremely good job in staying abreast of spring grain developments in the Soviet Union, and that the work of’ the USSR Grains Task Force has had a great deal to do with this.

Mr. Chairman, I will be pleased to respond to questions.

BACKGROUND STATEMENT ON U.S.-U.S.S.R. AGREEMENT OF COOPERATION FOR THE TECHNOLOGY ASSESSMENT BOARD

(Prepared by Foreign Agricultural Service)

The Department of Agriculture’s analysis of Soviet agricultural conditions’ has improved as a result of two new inclusion-data provided by the Soviets under the June 1973 Agreement on Agricultural Cooperation, and increased use of corroborative data from other sources, in particular U.S. programs to gather weather data.

In the past, USDA analysis of Soviet agricultural conditions, as for other nations, relied most heavily on reporting from the U.S. Agricultural attache, reports from Soviet and other press outlets on agriculture, and publications provided by the foreign government. While these steps continue to play an important role, progress with the Soviets since 1973 is enabling the United States to obtain some information more quickly, and expand our data bases. There remain, however, some areas in our analytical work, particularly in forward forecasting, where we have not been able to implement the cooperation with Soviet officials which we desire.

The June 1973 Agreement on Agricultural Cooperation between the United’ States and USSR calls for the following:

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Quicker access to data is helpful in the compilation of periodic statistical reports by USDA and research is facilitated by the rapid availability of data (as opposed to unofficial estimates) on production and utilization.

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Despite the relatively good performance of the Soviets in providing data in those categories for which a program has been worked out to implement provisions of the Agreement, there has been little progress in acquiring data to enable an improved assessment of current production and foreign trade prospects. The Soviets have not yet demonstrated willingness to implement the forward estimates provision of the Agreement. Efforts by the United States to attain implementation of! this provision, on the whole, have thus far not been successful in attaining either the forward estimates or a schedule for their future supply. Efforts are continuing. Data acquired under the agreement probably will continue *to* make only a marginal contribution to current situation and outlook work on grains and feeds until a program is worked out to implement the provision of forward estimates.

Aside from the data requests, some progress has been made in the exchange of economic information under the Agreement. Three separate teams to tour growing areas and analyze production conditions for winter wheat, spring wheat, and sunflowers visited the USSR in 1975. In addition, a team on livestock and feed use visited in early 1975. Although these teams had some itinerary difficulties, their acceptance was a considerable improvement over the one such team (winter wheat) in 1974. These teams facilitate, but are not sufficiently adequate for, estimates of Soviet crops. The Soviets also have begun to accept the idea of regular bilateral discussions of agricultural production and trade at meetings under the Agreement, although Soviet presentations rarely have included outlook information. Perhaps most important, the range of contacts with Soviet officials in a wide variety of organizations dealing with agriculture has increased greatly under the current Agreement. The development of these relationships throughout the Soviet bureaucracy could eventually lead to a much wider exchange of information.

Inter-agency cooperation in the U.S. Government also makes an important contribution to USDA analysis of the Soviet situation. A prime example is in the gathering and application of weather data to both confirm Soviet reports and assist in making estimates of current Soviet production prospects.

Weather data are used extensively in making forecasts of Soviet grain production. The principal source of weather data used by Soviet analysts in the Department of Agriculture is the Air Force Environmental Technical Application Center (ETAC). ETAC computerizes and processes raw weather data and provides average information on 27 regions within the USSR on precipitation (absolute and percent of average), temperature (absolute and departure from average), and calculated soil moisture (absolute and percent of average). Data are summarized and made available each 10 days, with the data generally available within 5 days at the end of the period. In addition, cumulative monthly and seasonal averages also are provided.

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TREATIES AND OTHER INTERNATIONAL ACTS SERIES 7650

COOPERATION IN AGRICULTURE

Agreement Between the
UNITED STATES OF AMERICA
and the UNION OF SOVIET
SOCIALIST REPUBLICS

Signed at Washington June 19, 1973

68-877 O—76----5

NOTE BY THE DEPARTMENT OF STATE

Pursuant to Public Law 89-497, approved July 8,1966 (80 Stat. 271; 1 U.S.C. 113)—

"... the Treaties and Other International Acts Series issued under the authority of the Secretary of State shall be competent evidence . . . of the treaties, international agreements other than treaties, and proclamations by the President, of such treaties and international agreements other than treaties, as the case may be, therein contained, in all the courts of law and equity and of maritime jurisdiction, and in all the tribunals and public offices of the United States, and of the several States, without any further proof or authentication thereof."

UNION OF SOVIET SOCIALIST REPUBLICS

Cooperation in Agriculture

Agreement signed at Washington June 19, 1973;
Entered into force June 19, 1973.

TIAS 7%50

AGREEMENT BETWEEN
THE GOVE RNMENT OF THE UNITED STATES OF AMERICA AND
THE GOVERNMENT OF THE UNION OF SOVIET SOCIALIST REPUBLICS
ON COOPERATION IN THE FIELD OF AGRICULTURE

The Government of the United States of America and the Government of the Union of Soviet Socialist Republics;

Taking into account the importance which the production of food has for the peoples of both countries and for all of mankind;

Desiring to expand existing cooperation between the two countries in the field of agricultural research and develpment;

Wishing to apply new knowledge and technology in agricultural production and processing;

Recognizing the desirability of expanding relationships in agricultural trade and the exchange of information necessary for such trade;

Convinced that cooperation in the field of agriculture will contribute to overall improvement of relations between the two countries;

In pursuance and further development of the Agreement between the Government of the United States Of America and the Government of the Union of Soviet Socialist Republics on Cooperation *in* the Fields of Science and Technology of May 24, 1972, [1] and in accordar with the Agreement on Exchanges and Cooperation in Scientific, Technical, Educational, Cultural and other Fields of April 11, 1972,[2] and in accordance with the Agreement on Cooperation in the Field of Environmental Protection of May 23, 1972;[3]

Have agreed as follows:

[1] TIAS 7346; 23 UST 856.
[2] TIAS 7347; 23 UST 790.
[3] TIAS 7345; 23 UST 845.

3

ARTICLE I

The Parties will develop and carry out cooperation in the field of agriculture on the basis of mutual benefit, equality and reciprocity.

ARTICLE II

The Parties will promote the development of mutually beneficial cooperation in the following main areas:

1. Regular exchange of relevant information, including forward estimates, on production, consumption, demand and trade of major agricultural commodities.
2. Methods of forecasting the production, demand and consumption of major agricultural products, including a conometric methods.
3. Plant science, including genetics, breeding, plant protection. and crop production, including production under semi-arid conditions.
4. Livestock and poultry science, including genetics, breeding, physiology, nutrition, disease protection and large-scale operations.
5. Soil science, including the theory of movement of water, gases, salts, and heat in soils.
6. Mechanization of *agriculture*, including development and testing of new machinery, equipment and technology as well as repair and technical service.
7. Application, storage and transportation of mineral fertilizers and other agricultural chemicals.
8. Processing, storage and preservation of agricultural commodities, including formula feed technology.

9. Land reclamation and reclamation engineering, including development of *new* equipment, designs and materials.
10. Use of mathematical methods and electronic computers in agriculture, including mathematical modeling of large-scale agricultural enterprises.

Other areas of cooperation may be added by mutual aqreement.

ARTICLE III

Cooperation between the Parties may take the following forms:

1. Exchange of *scientists*, specialists and trainees.
2. Organization of bilateral symposia and conferences.
3. Exchange of. scientific, technical and relevant economic information, and methods of research.
4. Planning, development and implementation of joint projects and programs.
5. Exchange *of* plant germ plasm, seeds and living material.
6. Exchange of animals, biological materials, agricultural chemicals, and models of new machines, equipment and scientific instruments.
7. Direct contacts and exchanges between botanical gardens.
8. Exchange of agricultural exhibitions.

Other forms of cooperation may be added by mutual agreement.

ARTICLE IV

1. In furtherance of the aims of this Agreement, the Parties will, as appropriate, encourage, promote and monitor the development of cooperation and direct contacts *between*

governmental and nongovernmental institutions, research and other organizations, trade associations, and firms of the two countries; including the conclusion, as appropriate? of implementing agreements for carrying out specific projects and programs under this Agreement.

2. *To assure* fruitful development of cooperation, the parties will render every assistance for the travel of' scientists and specialists to areas of the two countries appropriate for the conduct of activities under this Agreement.

3. Projects and exchanges under this Agreement will be carried out in accordance with the laws and regulations of the two countries.

ARTICLE V

1. For implementation of this Agreement, there shall be established a US-USSR Joint Committee on Agricultural Cooperation which shall meet, as a rule, once a year, alternately in the United States and the Soviet Union, unless otherwise mutually agreed.

2. The Joint Committee will review and approve specific projects and program of cooperation; establish the procedures for their implementation; designate, as appropriate, institutions and organizations responsible for carrying out cooperative activities; and make recommendations, as appropriate, to the Parties.

3. Within the framwork of the Joint Committee there shall be established a Joint Working Group on Agricultural Economic Research and Information and a Joint Working Group *on* Agricultural

Research and Technological Development. Unless otherwise mutually agreed, each Joint Working Group will meet alternately in the United States and the Soviet Union at least two times a year. The Joint Committee may establish other working groups as it deems necessary.

4. The Executive Agents *for* coordinating and carrying out this Agreement shall be, *for* the Government of the United States of America, the United States Department of Agriculture, and for the Government of the Union of Soviet Socialist Republics, the Ministry of Agriculture of the USSR. The Executive Agents will, as appropriate, assure the cooperation in their respective countries of other institutions and organizations as required for carrying out joint activities under this Agreement. During the period between meetings of the Joint Committee, the Executive Agents will maintain contact with each other and coordinate and supervise the development and implementation of cooperative activities conducted under this Agreement.

ARTICLE VI

Unless an implementing agreement contains other provisions, each Party or participating institution, organization or firm, shall bear the costs of its participation and that of its personnel in cooperative activities engaged in *under* this Agreement.

ARTICLE VII

1. Nothing in this Agreement shall be interpreted to prejudice Or modify any existing Agreements between the Parties.

2. Projects developed by the US-USSR Joint Working Group on Agricultural Research which were approved at the first session of the US-USSR Joint Commission on Scientific and Technical Cooperation on March 21, 1973, will continue without interruption and will become the responsibility) of the US-USSR Joint Committee on Agricultural Cooperation upon its *formal* establishment.

ARTICLE VIII

1. This Agreement shall enter into force upon signature and remain in force for five years. It will be automatically extended for successive five-year periods unless either Party notifies the other of its intent to terminate this Agreement not later than six months prior to the expiration of this *Agreement*.

2. This Agreement may be modified at any time by mutual agreement of the Parties.

3. The termination of this Agreement will not affect the validity of implementing agreements concluded under this Agreement between institutions, organizations and firms of the two countries

DONE at Washington, this 19th day of June, 1973, in duplicate, in the English and Russian languages, both texts being equally authentic.

FOR THE GOVERNMENT OF THE UNITED STATES OF AMERICA:	FOR THE GOVERNMENT OF THE UNION OF SOVIET SOCIALIST REPUBLICS:
Earl L. Butz [1]	А. Громыко [2]

[1] Earl L. Butz
[2] A. Gromyko

Chairman HUMPHREY. Dr. Hathaway, we welcome you. In light of the time that we have you might want to summarize your statement; and we, I can assure you, will read it very, very carefully.

STATEMENT OF DR. DALE E. HATHAWAY, DIRECTOR, INTERNTIONAL FOOD POLICY RESEARCH INSTITUTE

Dr. **HATHAWAY.** Thank you, Senator.

I thought I might just make it clear at the outset that I do not speak for the Food and Agricultural Organization of the United Nations - nor the United States or any other government; but I represent a newly formed research institute and thus what you have are my views of the FAO food information system. I have described the components of the much improved FAO system in the paper that I will submit for the record.

In view of the time, I would just like to go directly to the recommendations that might be related to the U.S. role relative to FAO'S food information system. It seems to me that, first, the United States should actively cooperate in continuing to supply FAO the information that the U.S. Government, has available to it. The problems that may be involved in this can best be discussed by some of the people that will be appearing before you tomorrow and subsequently.

Second, since the FAO system, like every other system in the world that is available in general, is totally inadequate because of the lack of accurate information on the U.S.S.R. and the People's Republic of China, I believe, strongly that, we should use our persuasive powers as an exporter and as a major supplier of food aid to encourage those countries which withhold information from the international system to provide that information so that it is available to everyone.

Third, I strongly suggest the U.S. Government ought to increase its support for the improvement of statistical systems in developing countries, and to use our advanced technology, and to put a good deal of cooperative research effort in the application of that technology to the particular problems of crop reporting in developing countries. These problems are of a substantially different nature than they might be in the U. S. S. R.: because there is a difference between satellite technology in half-acre rice paddies and 10,000-acre wheat farms; and I am not sure that the technological problems are fully realized in the case of developing countries, and yet the statistics are really very poor there, as I pointed out.

Fourth, as a major contributor to the FAO and other United Nations organizations concerned with food information systems, I think the U.S. Government should take leadership in insuring that such activities receive the funds that the-y need to develop an adequate international food information system. One of my fears is that our Government, because it does have one of the best reformation systems in the world, may pay too little attention to the food information system for the world, which is really the FAO) food information system. In so doing, the U.S. may leave the rest of the world, and particularly the developing countries, with totally inadequate information and, as a result, they may make large, erroneous policy decisions based on inaccurate or incomplete information. Basically, this brings me to a question directly related to Mr. Bell's testimony; and it relates to the information the U.S. Government is obtaining or will obtain under some kind of agreement with the U.S.S.R. and other countries which are now not generally releasing good information. I think there is a major question as to whether the U.S. Government should maintain that information for its exclusive use or make it available to the world. I feel very strongly it should be available to the world, so that other nations also know what is likely to happen in terms of supplies, availability, et cetera.

Chairman HUMPHREY. I thoroughly agree with that. I think it is information of interest to everyone. And it is vital for every country that has to do its own planning in terms of imports, exports, crop planning, and eveything involved with agricultural production.

Dr. HATHAWAY. I will end my comments and submit this longer statement, which outlines the FAO information system, for the record.

Chairman HUMPHREY. Could you give us the elements, of that FAO information system as it is now constituted?

Dr. HATHAWAY. Well, basically, it consists of four elements. It is a food situation and outlook series, which now include monthly and quarterly bulletins, an early warning of food shortages, an information system on foodstocks and food aid, and fertilizer and pesticide information.

Chairman HUMPHREY. Is this information current? Is the FAO getting this information?

Dr. HATHAWAY. There has been a very substantial improvement in the FAO's timeliness; particularly with the development of their early warning and food shortage system. It is not qualitative in terms of precise estimates, but it gives early indications of major trouble spots in the world. I think it is of special importance in terms of timeliness of information regarding potential world trouble spots, particularly for the developing countries which may require massive food aid from national or international sources.

No organization that I know of has antything a preaching an adequate information system on fertilizing and pesticides. This is of major importance to the United States and to U.S. farmers, and to other countries. It is a very complex situation. I think the information is neither timely, not very accurate, and the coverage is not very good.

Chairman HUMPHREY. That's on fertilizer?

Dr. HATHAWAY. That's on the fertilizer part. But my feeling on the food information and the early warning, the FAO system is substantially improved in terms both of its coverage and its timeliness.

Chairman HUMPHREY. Your feeling is that as a reserve food country and one that significantly contributes to agricultural trade, that the effectiveness of FAO's system should be of vital concern to us?

Dr. HATHAWAY. I do, indeed. Because as you pointed out in opening, India last year was the largest purchaser of wheat. As one looks at the potential developments in the world over the next decade, it is increasingly likely that the developing countries, some of them with ample foreign exchange reserves, will become increasingly major customers of the United States. And it is important that they have this information, just as vice versa.

And equally important, I think, that we put pressure on their governments to do a better job of crop reporting and a more realistic job of estimating their needs.

Chairman HUMPHREY. All right.

Mr. Cordaro, do you have any questions you want to ask to Mr. Hathaway?

By the way, Dr. Hathaway, we are very appreciative of getting your statement early so that we summarize and digest it. We are getting very close to finishing this assessment, aren't we?

Mr. DADDARIO. Once these hearings are over with, Senator Humphrey.

Chairman HUMPREY. And the emphasis that you can bring to us is most helpful.

Mr. CORDARO. Mr. Chairman, I would like to ask one question. It's very relevant to the foreign assistance bill that is now pending.

Dr. Hathaway, is it possible to be more specific about what kind of technical assistance or training or use of technologies that AID, through our foreign assistance program, should emphasize in working with developing countries to improve their information systems capabilities ?

Dr. HATHAWAY. Well, as I state in here, the gathering of accurate and timely information is just not a glamorous job wherever it's done. It generally does not get a very high priority in an-y country, including our own; because until you get in a crunch and the decisionmakers need it, information gathering does not get high priority. It seems to me that in our foreign assistance program, we should repeatedly remind the decisionmakers in other countries that they cannot make rational food policy without better information about their own food situation and the world food situation, and then work either directly with them, or through the international organizations to provide the technical expertise that will provide it.

We also have a question of some countries which, for their own reasons, will not, disclose, to FAO even thouogh they are members and cooperating members, all of the data and their crop estimates. And my impression in that we ought to put more pressure on such countries to be fully cooperative in terms of projections.

Chairman HUMPHREY. Would it be desirable to ask the United states to have copies of agricultural attache reports sent directly to FAO at the same time they are sent to Washington?

Dr. HATHAWAY. I believe that there is some exchange of information, in fact, a good deal of exchange of information from the attache reports to FOA now. I do not know as to what the timing of that flow is. Dr. West or Dr. Paarlberg, I think, could inform -you on that.

But it seems to me that it is pretty important that the United States cooperate fully because in many cases, our attache estimates, I believe, are some of the best estimates in the developing countries.

Chairman HUMPHREY. I think that's perhaps the best information that we are able to get.

I'd like to make sure that for the report on the bill we get a statement about the cooperation of AID in the agricultural title of the act. to em emphasize the development of information capability along with the productive capability of those countries. We tied in a new title on our Foreign Assistance Act, as you know, on the land-grant colleges. They could be very helpful.

Dr. HATHAWAY. Yes, indeed.

Chairman HUMPHREY. Dr. Wilcox, do you have any questions?

Dr. WILCOX. Well, since Dr. Hathaway represents a new institution, wouldn't it be beneficial to have him put in the record a statement describing it?

Chairman HUMPHREY. Could you give us some idea of the purpose and objectives of the International Food Policy Research Institute?

Dr. HATHAWTAY. Basically, if you don't object, I have a very short statement I would put in the record; and to summarize, we are a newly organized—

The International Food Policy Research Institute [1]—nonprofit research and education institution, located here in Washington, to do research on the major food policy issues, international in nature, concentrating on certain key issues relative to the potential problems faced in feeding the population of the developing world.

Mr. DADDARIO. Dr. Hathaway, you made what I believe is a very interesting point on the. need for the United States to take the lead in developing the statistics and the ways and means by which the statistics are developed in the developing countries, because they don't have the capabilities.

What are the problems that you see in stating that we should take the lead ? Perhaps that's an easy thin to say. But what do you see as the problems in their willingness to o that, a concern about the size of the U.S. involvement in what they do, and in the problems in getting us to the point where that could be effectively done?

Dr. HATHAWAY. Basically, it would seem to me that one would approach it, if you are going to do it on a bilateral basis, by picking some countries which clearly are open and friendly and concerned about such matters, and entering into some kind of collaborative research as to what can be done with these advanced technologies under these conditions.

If you then can produce some results that prove that it can be done and that it is useful for the developing countries to have it done, then either through the international organizations or-other countries I think will then become interested.

Right now I think part of the skepticism rests, in the countries that I have been working in, which is largely Asia, is that we are flying satellites around and looking at them, but they don't see anything coming out of that that tells them anything they want to know. And I think you have to start by saying: We believe we can produce information of importance to you in a collaborative way, and do it a piece at a time. It involves some fairly sophisticated research in the use of high-level technology under very difficult conditions.

Mr. DADDARIO. You foresee, then, posibilities in this order: Relationships with countries, with a country or two countries which were friendly, where some of the same problems exist in all types of developing countries, building a prototype of some kind which, over the course of a period of time, would show its effectiveness and show our own goodwill, something of that order?

Dr. HATHAWAY. And then possibly, for those countries which do have concerns about the United States, its size, its policy position, and so on, essentially make this technology available to one of the international organizations which other countries cooperate with on a continuing basis. But right now the international organizations do

[1] See p. 80.

not have the high-level technology and the funds to carry on large-scale experimentation on some of these things.

Mr. DADDARIO. And even though that large-scale experimentation would be quite costly, If you take into consideration your concerns, if it would be able to be done, what would be your guess as to the ultimate tradeoff in cost?

I)r. HATHAWAY. It might be very positive, because if one finds that a country with a very large population suddenly discovers that it has a massive shortfall and we are either forced to step in with large-scale foreign aid or the countries that can have a major impact on the market, if they have the foreign exchange--It seems to me that we can avoid the kinds of fluctuations in our market and the unplanned actions that have been a concern since the shortfall in the Asian rice crop. It can easily, in a bad monsoon year, be roughly the equivalent of the shortfall in the Russian wheat crop; and many people in those countries are living on a margin of subsistmce and somebody in the world is most likely going to have to make that up, and that means the United States, in large part under the current situation.

Chairman HUMPHREY. This is valuable information. I wish that every Member of Congress could know this. You would be surprised at the problems we have trying to convey the sensitive nature of the food supply situation.

Just as you have indicated, it is entire] y probable in the rice-consuming areas, to have a bad crop. It is not unknown. In fact, it is more common than uncommon. The American rice crops often provides the necessary reserve. Fortunately, we have a big rice crop again this year.

Mr. DADDARIO. Well, if we were to follow this suggestion and develop this prototype, would the development. of this be useful ?

Dr. HATHAWAY. I think the technology itself-and I am not well informed at all on this-but the technology itself, of getting accurate estimates on very small farms which are under water, anywhere from 4 inches to 4 feet, is something else from getting accurate estimates in Kansas or the Ukraine, that's all.

Mr. DADDARIO. Well, it is a use of the technology in a different way than we are presently using it.

Dr. HATHAWAY. Much more complex. Multiple crops on the same land at the same time in different growing stages. I think it is a technological problem as much as a—as an international problem of the use of such technology if it were available.

Chairman HUMPHREY. When you see multiple cropping in China, for example, you see two or three crops in the same row and all at different growing stages. It is remarkable. I don't think any satellite is going to pick that out very well. Someone must. walk around to see this and feed that information in at this particular time. We are just beginning to experiment with double cropping.

Thank you very much.

Dr. HATHAWAY. Thank you, Senator.

[The prepared statement of Dr. Hathaway follows:]

STATEMENT OF DR. DALE E. HATHAWAY, DIRECTOR, INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Senator Humphrey, members of the Technology Assessment Board, I am pleased to be able to appear before you to comment on the world food, agriculture, and

nutrition systems, a matter of significance to all concerned with food policy decisions at the national and international level. Since others will be discussing the information and analytical systems of the U.S. Government, as requested by Chairman Teague in his letter of August 29, 1975, I will concentrate my comments on the expanded Global Information and Early Warning System on Food and Agriculture of the Food and Agriculture Organization of the United Nations (FAO). At the outset, 1 should like to make it clear that 1 speak as the director of a newly formed, independent research institute keenly interested in, and dependent upon the statistics available from such sources; and not as a representative of any government or the FAO. I have, however, had the full cooperation of the North American Office of FAO and of FAO officials in Rome regarding the nature of and plans for their food information system ; but, they have no responsibility for my comments.

First, it should be noted that the FAO took the initiative in this area prior to the World Food Conference in November 1975. FAO recognized that an adequate World Food Security Programme required accurate and timely information on world food conditions. Thus, the improved system called for by the World Food Conference in Resolution XVI was already being planned before that Conference, and it was endorsed in principal by the FAO Council in its November 1974 session immediately following the World Food Conference. Thus, the system we are discussing is not merely a hasty reaction to a current crisis, but expansion and improvement of a system that has evolved from FAO'S long history of dealing with food problems and the related policy decisions.

Second, it should be noted that most of the problems and deficiencies I shall mention later are largely those faced by any attempt at collection and dissemination of data from a large number of governments with diverse information assembling capabilities and dissemination policies. Partially these deficiencies can be attributed to the limitations on FAO action inherent in an international or intergovernmental organization.

At the outset, I should like to comment on the use of information and analysis in policy making. I shall start with the obtaining and disseminating of information and later discuss analysis and use of the available information.

Presumably we are talking about current information that is of value to policymakers in current policy decisions.

Information for policy making purposes ideally must be timely, adequate in coverage, and accurate. On the face of it, this seems to be obvious, but a failure to distinguish among these characteristic and their importance can cause confusion, malallocation of scarce resources in the information-gathering field, and a failure to recognize where the major efforts for improvement should be placed. Let me illustrate the difference.

Timeliness is the most obvious and widely recognized attribute of information for policy makers. It is of little help to tind out that the grain crop in a major producing country has failed some time after they have entered world markets and made major purchases. It is of no great help to find that a portion of the population in a country, large or small, faces starvation due to crop failure when it is too late to effectively mobilize national or international emergency relief programs.

The adequacy of the information is a different matter entirely. Adequacy relates both the items covered in the information system and the extent of the coverage. Moreover. adequacy must be judged relative to the policy actions contemplated. From the standpoint of international production, trade and aid policies, it is completely unrealistic to talk of an adequate food information system that does not have timely and reasonably accurate information on agricultural conditions in the world's second and third largest grain-producing countries—the USSR and the People's Republic of China. On the other hand, the absence of such data from a country whose population or food production is small is not of major significance to world markets and to other countries' well-being. Thus, the adequacy of data for countries with small production and consumption levels is primarily their concern, and if they choose for one reason or another not to provide such information, they are more likely to be harmed as a result than is the rest of the world. On the other hand, timeliness of information provided is just as important for small countries as large ones when issues of food aid, disaster relief and similar matters are involved; a starving person in a small country is just as badly off as one in a very large country if food aid arrives too late. Thus, timely information is essential for the effective operation of world food programs or a bilateral aid program, Accuracy of information is always of importance to policy makers, but here again it relates to magnitude of the populations and production involved. A ten percent error in production estimates for large countries such as India, the USSR China or the USA creates substantially greater problems for world policy makers than a 50 percent error in the production estimate of a country that produces or consumes a few hundred thousand tons of grain annually. Unfortunately, statisticians are often more concerned about estimating errors than policy implications of such errors and thus may be overly concerned with accuracy in some cases.

Thus, for a food information system to serve the needs of policy makers it needs to be timely for all countries; to be adequate, it needs to provide a wide range of information for those countries whose actions and/or needs can have a major impact on world markets; and it needs to be accurate in most respects for those countries that can or are likely to affect world markets. Of course, for national purposes all countries would benefit from timely, adequate and accurate information; but from the point of view of international policy makers the importance of adequacy and accuracy of food information regarding other countries varies greatly depending upon the nature of the policy issue involved.

With these comments as background, let me review briefly the status and plans of FAO for its Global Information and Early Warning System. In the past the FAO and the U.S. Government were the two major sources of world food information. The FAO statistics were published annually in *The State 01 Food and Agriculture*, and their various statistical publications. The statistics were generally a year to eighteen months old and thus failed to meet the criterion of timeliness. The *Monthly Bulletin on Statistics*, the Early Warning System, and commodity publications provided more current data, especially in recent years on particular commodities and commodity groups. The new food information system represents a step forward in providing a greater emphasis on a more coordinated and timely approach.

The new FAO food information system has four basic types of output: 1) the food situation and outlook series, 2) an early warning of food shortages, 3) information on food stocks and food aid, and 4) fertilizer and pesticide information. Let me comment on each.

THE FOOD SITUATION AND OUTLOOK SERIES

This now consists of monthly, quarterly and ad hoc reports. They cover the food supply-demand outlook in light of changes in production prospects, prices, policies, sales, stocks and the availability and prices of key inputs such as fertilizer, pesticide, shipping, etc.

The Food Outlook Quarterly has now been published twice, the last dated August 25, 1975 and the next scheduled for release November 28, 1975.

The monthly Food Situation Report presents, more briefly, developments during each preceding month on factors affecting the world food situation, covering much the same material as the Quarterly, updating those items which have changed from the previous report.

My appraisal is that this new series will solve the timeliness problem to a large extent. Its gaps are in adequacy and accuracy, neither of which is the fault of the persons who produce the reports. In terms of the range of information covered, the adequacy is excellent; but in terms of world coverage, it is inadequate be cause the USSR is not a member of FAO and has thus far been no more cooperative with them than others regarding this information. The People's Republic of China, although a member of FAO, has not yet seen fit to provide the information requested for the system. Thus, the FAO food information system, in common with others which are generally available to most governments, is totally inadequate in terms of coverage of two of the world's largest agricultural producers and consumers. Until these countries choose to cooperate, no system can be adequate in terms of coverage.

Moreover, at the insistence of some Member Governments, statistics for a country may be, at the request of that government, only shown as part of area or world totals. This, again, limits the adequacy if the country is significant in world production, consumption and trade.

The problem of accuracy is two-fold. The first and most significant is the sheer inability to produce accurate information in developing countries with present indigenous technology. Despite the large quantities of technical assistance from FAO and national governments, the problem of producing reasonably accurate estimates in developing countries is enormous and far from solved. Hopefully, improved technology and more assistance can improve this situation. The World

Food Conference Resolution XVI establishing the Global Information and Early Warning System specifically requested governments to take steps to improve their data collection and dissemination services. Regular assessments of the effects of current weather on crop production was also emphasized.

Another accuracy problem arises because some countries simply do not want to admit that their agricultural economy is performing badly, and they do not report or are slow to report the facts regarding agricultural production. However, since FAO is governed and financed by its Member Governments, it must have a substantial basis to modify the official estimates of the Member Government, estimates that in the absence of objective statistics may represent hopes rather than actual achievements or expected performance. The reasons for such actions on the part of governments are varied and sometimes valid, but they reduce the accuracy of world food information.

EARLY WARNING OF FOOD SHORTAGES

A monthly summary of the latest information on crop conditions, weather and plant diseases, food deficits and availabilities in some 90 countries is published in Foodcrops and Shortages. This contains largely qualitative estimates of conditions including a rating scale of crop conditions, plantings, progress of harvest, and rainfall, plus comments or observations from FAO representatives, project specialists, World Food Programme officers and other sources.

The most valuable attribute of this portion of the system is its timeliness. The reporting of adverse weather conditions, natural disasters and other events which may affect crop availabilities and demands is a great aid to those who must make rapid policy decisions in advance of the final quantitative estimates,

The adequacy of information available in this part of the system varies greatly from country to country. This is partly a lack of an adequate support system and, in some cases, lack of country cooperation.

In the case of the early warning system, quantitative accuracy is almost impossible by definition. As yet the relationships between weather or insect and disease appearances are not well quantified, nor is a direct and stable relationship likely to be found in the near future. Thus, the qualitative estimates now used probably are as good as can be devised given the state of knowledge regarding these relationships.

FOOD STOCKS AND FOOD AID INFORMATION

World food stocks: status and evaluation reports were authorized by the FAO Conference of 1973; they include assessment of national stock targets and policies and the adequacy of world cereal stocks in the context of world food security ; they also include data on storage capacity and facilities. The latest one was issued for the coming October meeting of the FAO Group on Grains

The FAO Food Aid Bulletin issued quarterly since July 1970 provides information on bilateral and multilateral food aid transactions and food aid availabilities, based on notifications made by governments to FAO and data especially provided by international agencies concerned.

FERTILIZER AND PESTICIDE IN' FORMATION

The FAO fertilizer and pesticide information is an off-shoot of their newly established International Fertilizer Supply Scheme. Information on supplies, deficits, prices, contracts and capacities are monitored for the purposes of emergency operations under the scheme. A new quarterly fertilizer survey and other information-gathering activities have been initiated. Steps are being taken to develop a similar information system on pesticides.

In this area of key inputs, I must judge that the information is neither timely, accurate, nor adequate. The reasons for this vary. First, the production and distribution of these products are carried on by a mix of private and public enterprises, sometimes within the same country. Some countries, for their *own* reasons, do not divulge their current statistics on current status or plans even though they presumably have them. The private firms involved often are reluctant to disclose information which they believe may affect their competitive position. All in all, the situation is totally unsatisfactory in both current estimates and forecasts and the problem of accurate information an exceedingly difficult one.

As an illustration, in the months just prior to the World Food Conference in 1974, a series of estimates on world fertilizer production, use, avilability and potential capacity in the short and longer run were prepared by several national

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and international organizations. They varied widely in several aspects and changed markedly during a short period of time. The situation regarding pesticides appeared equally confusing.

It is clear that governments and the FAO need to spend much more time and money in devising and implementing an improved information system for this important area relating to agricultural production. I would expect it to be a difficult process, leaving aside the fact that some major countries may not wish to cooperate.

One final point on the FAO information system. By action of Member Governments it is a closed system. By that I mean certain of the materials are limited in distribution only to participating countries and cooperating international organizations for their exclusive use. This includes the monthly Food Situation Reports, the reports on crop conditions and food situations by countries and the special reports. The Food Quarterly Outlook is distributed to participating governments, to nonparticipating governments which are members of FAO, and to cooperating international organizations.

Thus, most of the material produced by the FAO food information system is not available to the general public and media. This condition was imposed by some Member Governments which believe that a disclosure of such information would give an advantage to private traders and speculators.

My own view is that such restrictions on the FAO system are wrong and that more and better information widely shared would reduce the advantages of those who cause concern. First, the large private international traders have their own complex' information system that gives them an advantage that better public information would reduce or remove. Second, the major destabilizing forces in the market are governments that operate state trading operations in secrecy. But, right or wrong, these restrictions on the FAO system do exist and are likely to persist.

I hope I have not appeared overly critical of the FAO food information system. It represents a marked improvement over what has existed, and if it were adequately financed and received the full cooperation of Member Governments, it would be of significant aid to national and international policy makers.

It appears, based entirely on an examination of FAO budget documents, that far too little budget priority is given to such work by FAO. For the system to work as effectively as it could, it needs at least regional, and generally country statistical representatives, to provide information and reports to the Rome headquarters. This is in addition to the persons at the regional level who work with countries on upgrading the timeliness and accuracy of country data. Given the magnitude of their task it would appear that the Rome staff needs to be expanded. But, this again is a matter for decision on FAO'S program of work and budget, a decision made by Member Governments and, unfortunately the provision of timely, adequate, and accurate food information is less visible and glamorous than other activities that compete for scarce funds.

THE ANALYSIS PROBLEM

Thus far I have commented upon the data base for the food information system of FAO. But, even if all the data were timely, adequate, and accurate the utility depends upon its use in policy analysis. Facts without analysis often are not much more use than analysis without facts. And as we have seen recently, even within the U.S. Government, the same facts can be interpreted differently and different policy conclusions reached.

Essentially competent policy analysis should present an in-depth analysis of policy options and their implications for the parties concerned. At this point one enters the area of who gains and loses by certain policies or lack thereof. Such areas are sensitive in that they involve national political decisions, and that may at times have adverse effects upon others.

In this area FAO faces a problem created by the nature of the organization. The reporting of facts is a much less sensitive area than analysis of what actions need to be taken by whom. Here FAO directly encounters sensitive problems of national sovereignty. It is one thing to point out that there is a serious gap between the food and needs of the Most Seriously Affected Nations and another to suggest to the U.S. Government or to the EEC that they should do more in providing food aid. As I understand the rules of the game in international organizations, it is acceptable for one nation to publicly question another's policy, but it is not acceptable for the staff of an international organization composed of member nations to do so.

Thus, I would think it is expecting too much of the FAO to provide substantial policy analysis which is explicitly critical of national policies. This means that policy analysis must rest with national governments and organizations outside the formal United Nations framework. This, of course, means that a substantial imbalance between nations occurs. The United States and many other developed, wealthy nations have a large core of trained professionals available to analyze the food information available to the government. Many developing nations have neither the trained manpower or resources for such analysis, nor do they always accept analysis done by other governments. The International Food Policy Research Institute represents a modest effort to redress that imbalance. It is our intention to do such analysis and to collaborate with countries interested in such work and in developing such capabilities within their own countries.

WHAT CAN AND SHOULD THE U.S. GOVERNMENT DO TO IMPROVE THE WORLD FOOD INFORMATION SYSTEM ?

The prime interest of the Technology Assessment Board, as I understand it, is to assess the food, agriculture, and nutrition information systems and recommend action that can be taken by the United States to improve them. I shall confine my comments to U.S. Government actions which would be of aid in strengthening the FAO food information system, assuming that others will concentrate on the U.S. system.

First, of course, the United States Government should continue to actively cooperate with FAO in exchange of information available. Possible problems involved in that cooperation can be best discussed by U.S. Government representatives who will appear before this group.

Second, I suggest the U.S. Government should use its power and influence as the world's largest grain exporter and the largest supplier of food aid to try to persuade other governments to cooperate with the FAO in the provision of the information necessary to make the FAO food information system more timely and adequate in terms of country coverage.

Third, I suggest that the U.S. Government efforts be increased to aid developing countries improve their food information systems. This aid should include the development of and training for the provision of standard, statistical report procedures ; but, equally important it should involve the increased development of new and better information based upon the most advanced technologies. The U.S. capabilities in satellites, weather monitoring, and related fields needs to be more fully used in the food information field. To do so will require a substantial investment in research on weather-crop relationships. the use of satellites in conditions of small, fragmented, multiple-crop areas, and similar problems. This also involves sensitive problems of national sovereignty, and will require full cooperation with other nations and international organizations, Funding, and encouragement and leadership in that cooperation should be forthcoming.

Fourth, as a major contributor to the FAO and other United Nations organizations concerned with improved food information systems, the U.S. Government should take the leadership in ensuring that such activities receive the funds that an improved FAO food information system requires to become more effective. I am concerned that since the food information system of the U.S. Government is so good and also is undergoing substantial improvements there may be a tendency on the part of this government to have less concern for an effective international system. If my concern is correct, then an important point is being missed. Until and unless a large portion of the policy makers in all countries have equally good information, there is a continuing likelihood that actions on the part of others, possibly acting on the basis of inadequate information, will continue to be a major destabilizing force in world markets, food trade, and inhibit effective food aid actions.

In summary, great progress has been made in recent years in providing an improved world food information system. Much more needs to be done in order to make the system adequate to meet the needs of policy makers in the U.S. and all other governments. The actions of the IT. S. Government in this area can be an important factor in making the needed improvements.

[The following information was referred to on p. 73.]

Announcement of the Organization of the International Food Policy Research Institute

In response to a recommendation of the Technical Advisory Committee of the Consultative Group on International Agricultural Research of June 1974, entitled Proposal For A World Food Policy Institute, the international Food Policy Research institute (lFPRI) has been established.

The purpose of IFPR1 is to undertake research on selected policy problems affecting the production, consumption, availability and equitable distribution of food in the world with particular emphasis on the needs of the low income countries and especially the needs of the vulnerable groups within those countries. Specifically IFPRI will work:

(1) to identify major opportunities for expanding world food production with particular emphasis on the development actions and policies best suited to remove present constraints to production and to establish the framework for the sustained use of the potential agricultural capacities existing in low-income nations;

(2) to determine and publicize those actions which could be undertaken and those policies which could be adopted by governments, regional and international agencies, to effect a continued increase in the quantity and quality of food supplies available to all people through enhanced food production, wider trade opportunities, and improved effciency and equity in food distribution; and

(3) to provide information, an expanded base of knowledge and objective analysis of world food problems, and to indicate the opportunities and options open for their solution.

IFPRI has been established as a non-profit research and education institution under the laws of the United States of America. It is governed by an international board of trustees. The Board of Trustees currently includes the following persons: Sir John Crawford, Chairman; Ojetunji Aboyade, University of Ibadan, Nigeria; David Bell, The Ford Foundation, United States; Norman Borlaug, international Maize and Wheat Improvement Center, Mexico; Ralph Kirby Davidson, The Rockefeller Foundation, United States; Mohamed E1-Khash, Arab) Center for the Study of Arid Zones and Dry Lands, Syria; Nurul Islam, Bangladesh Institute of Development Studies, Bangladesh; Affonso Pastore, University of Sao Paulo, Brazil; Andrew Shonfield, Royal institute of international Affairs, England; Ruth Zagorin, International Development Research Centre, Canada.

In addition to the above trustees invitations have been issued to others, primarily from developing countries, to join the Board of Trustees.

The trustees met July 21 and 22, 1975, in Washington, D.C. to discuss the initial plan of work and staffing pattern of the Institute.

The Board of Trustees invited Dr. Dale E. Hathaway to serve as the first Director of IFPR1. He offcially assumed that position on a full-time basis effective August 1, 1975.

Source of Funds

The initial funds for the Institute's core budget have been provided by a grant from the International Development Research Centre of Canada. It is anticipated that the Rockefeller Foundation and Ford Foundation also will participate in the funding of the core budget. IFPRI has the legal authority both to receive contracts and to contract with other organizations for research. It is planned that, once the major staffing has been accomplished and the program of work developed, IFPRI will both accept and let contracts which are consistent with its mandate and the collaborative working relationships it wishes to establish at the national and international level.

The Staffing Pattern

The **staffing pattern that is planned for IFPRI is unique compared to most research organizations. The staff will consist of both social scientists and agricultural production scientists who will individually or cooperatively be responsi-Me for research problem areas within IFPRI's areas of concentration. The long-term professional staff is expected to consist of 7–8 persons drawn from the international community.**

In addition to the long-term staff the core budget provides for l&12 short-term staff, drawn primarily from developing countries, who will have appointments from one to three years duration. This portion of the staff is expected to vary in

seniority and also will consist of a mix of policy-oriented social and production scientists. It is hoped that these individuals will return to their home institutions and provide a continuing collaborative link between national agricultural research and policy analysis and the IFPRI program.

RELATIONSHIPS WITH OTHER ORGANIZATIONS

The success of IFPRI in achieving its mission will depend upon the building and maintenance of contacts with research organizations and policy makers at the national, regional and international level. Thus, the active cooperation of such groups is being and will be sought.

Discussions have already begun regarding cooperation with FAO, the World Bank, the Consultative Group on Food Production and Investment, the World Food Council Secretariat, and the network of International Agricultural Research Centers. As staffing and program development proceeds similar collaborative arrangements will be sought with national and regional organizations.

Although IFPRI will periodically assess the world food situation, both short and long-run, and analyze its policy implications, IFPR1 does not intend to generate primary statistics on food output. Instead, the Institute is intended to provide an independent source of research and analysis of the major food policy issues in both the current and long-run context.

THE FUNCTIONS OF IFPRI

The functions of IFPRI are research, analysis, and dissemination of information relevant to improving world food policy. At present it is not anticipated that 'the Institute will undertake a formal training program. As its competence in such research and analysis develops, it is hoped that its training function will be fulfilled through (a) the experience gained by short-term participants in the program and (b) the conduct of seminars and consultation on the major policy issues within the Institute's competence in response to specific requests from policy makers and researchers.

IFPR1 FACILITIES

The offices of IFPRI are located at 1776 Massnchusetts Ave., N. W., Washington, D.C. The address for communication purposes is: International Food Policy Research Institute, 1776 Massachusetts Avenue NW., Washington, D.C. 20036, telephone: (202) 833-1821, cable address: IFPRI, Washington, D.C.

Chairman HUMPHREY. Mr. Hjort, you are with John Schnittker and Associates here in Washington. Were you formerly with Secretary Freeman as well?

Mr. HJORT. Yes, indeed

Chairman HUNPHREY. Good, he would be happy to know that I have an old associate of his around. Orville is one of my closest friends.

You have listened here today and you also have a very extensive statement—one, that our staff has analyzed in considerable depth.

First, let me say we are very much indebted to you for the amount of work you have put into this statement, analyzing the information system, some of its needs, and structural weaknesses.

We will publish your entire statement, in the record. Could you please summarize it?

STATEMENT OF HOWARD W. HJORT, JOHN SCHNITTKER ASSOCIATES

Mr. HJORT. In view of that and since I have recently-prepared a dei ailed report, I will just highlight four or five major points.

The criteria I relied heavily upon for judging the strengths and weaknesses in the world agricultural information system were objectivity, reliability, timeliness, adequacy-in terms of coverage--efficiency and effectiveness.

When these criteria are applied it soon becomes evident that we don't have a world agricultural information system that ranks well in terms of all of them.

The main reasons, it seems to me, that our world information systems are held below potential are, first the deficiencies in the national agricultural information systems—several have already referred to such deficiencies of today.

Second, the adequacy of the information obtained by and reported to USDA and FAO through our attache network. These reports clearly are a primary source of intelligence for a world information system, but they are weak in some respects.

Third, the adequacy of the analytic ability to process the information, to trace its implications and to be able to get information on a timely basis to all those who need it for policy purposes or action programs or whatever.

Fourth, USDA operates both a national agricultural information system and a world agricultural information system. In my view, the manner in which the responsibility for those systems is assigned places objectivity in jeopordy, unnecessarily so.

Fifth, I believe that the organizational structure used by the Department of Agriculture in operating those systems seriously impedes the efficiency and effectiveness under which those two systems operate.

Now, going back over each point and being just a bit more specific about what I mean in each case. National information systems have deficiencies and will continue to have them for a long time. FAO has been working for years to help developing countries establish systems that can collect basic agricultural information and develop reliable supply demand estimates.

But that is a long-term task. We should continue to provide support to that effort, but we have to recognize that, it will take a great deal of time to bring all national systems up to the kind of standard that we will have to have for a reliable world system.

The near term alternative is to use analytic techniques where you take agricultural statistics, process them through a formal analytic model, verify it by seeing how well it performs historically, and then using model estimates to replace deficient ones from national systems.

An example of this is both the Central Intelligence Agency and the Department of Agriculture have a model, an analytic model, that they use to develop estimates of production in the Soviet Union. Neither one of those models has been sufficiently verified yet, but they are on the right track.

At the present time neither FAO nor USDA have the analytic capability to develop a sufficient model building and testing system. But the main point is that there is an alternative way of developing reasonably reliable estimates for a world system.

My second point, on reports from the attaches. First, I want to make clear that I recognize that USDA has been making serious efforts to improve the quality of those reports. But the fact of the matter is that few attaches are specialists in the collection of data- in analysis. And their mission, the attaches' mission, is not perceived to be the collection and analysis of data.

In addition, attaches are reposted frequently.

Now, these factors reduce efficiency and effectiveness and, in some cases, even reliability of the estimates that come from the attache.

We have two alternatives there, it seems to me, one is a long term, the other a near term selection. Over time the attaches can be replaced with a corps of specialists-people that are trained in the collection of statistics and in the analysis of agricultural information.

But in the short run, the only alternative is to obtain from the attaches sufficiently precise information so that it can be analyzed by analysts in Washington, more reliable estimates can be developed and reports to the world on the agricultural situation released.

We don't have anywhere near enough information coming from the attaches on the agricultural input situation. If you don't have information on inputs, it is very hard to get reliable information on outputs.

The other major weakness in the present USDA system, as far as analytic capability is concerned, is over the imbalance between their focus on production and Supply on the one hand, and the relative weak performance in terms of analysis of factors on the demand side.

The final point on the assignment of responsibility for operating the two USDA systems and need for reorganization, I believe that objectivity is presently threatened and efficiency and effectiveness clearly is held below potential.

Responsibility for the agricultural information systems is assigned to two different officials in USDA'S office of the Secretary-the Assistant Secretary for International Affairs, who was here earlier today, and Don Paarlberg, the Director of Agricultural Economics.

There are three separate agencies in the Department that share the responsibility for the operation of those two systems. The world system is operated in part by the Foreign Agricultural Service and in part by the Economic Research Service.

The Foreign Agricultural Service has a mission and a set of program responsibilities that makes it unnecessarily difficult for them to be able to maintain the objectivity of the system. The analyst in that organization is placed in a difficult position, because of the mission of the organization and its action program responsibilities. FAS has responsibilities for export programs which gives them a vested interest in the export estimates.

I would recommend, to protect the objectivity and improve efficiency and effectiveness, that the responsibility for USDA's world and national agricultural information systems be clearly assigned. I would recommend that it be assigned to the Director of Agricultural Economics, who already has the responsibility of the U.S. system and shares the responsibility for the world system, and that the agencies that report to the Director should have no other responsibility except providing economic intelligence-providing economic intelligence on U.S. and world agriculture.

There is another problem. The chairmanship of the committees that develop estimates of the U.S. supply-demand situation should rest with those agencies that have the responsibility for economic intelligence. There is, in my view, a very fatal flaw at the present time, because the fact is that the chairmanship of the committees that develop supply-demand estimates for U.S. agriculture rests with the Agricultural Stabilization Conservation Service. That organization does not have the overall responsibility for assessing and responding to the situation and outlook for U.S. agriculture.

There is a Crop Reporting Board that reviews and put its stamp of approval on the estimates coming through the Statistical Reporting Service. And I want to emphasize that in my view the Statistical Reporting Service in USDA is without parallel in the world with respect to the collection and reporting of agricultural statistics.

The Economic Research Service has an Outlook and Situation Board that reviews and approves U.S. agricultural situation and outlook reports.

The world assessments, either world production estimates or world trade estimates or assessments of the supply-demand balance that are made by FAS do not go through or to an overall board for review and approval. That also, I think, unnecessarily jeopardizes the potential objectivity of the systems.

Chairman HUMPHREY. Thank you. We have heard quite an extensive critique.

I didn't quite understand the reason to cut the Agricultural Stabilization Service out of the evaluations on production and demand.

Mr. HJORT. No; I would not cut them out, but at the present time they have the chairmanship for these committees. And the Economic Research Service and the Foreign Agricultural Service are the men hem.

Chairman HUMPHREY. Do you think the Economic Research Service should be in the chairmanship position while the others provide the input ?

Mr. HJORT. Right. We have this flaw in the system at the present time where the agency that has the responsibility for the overall assessments does not have the authority for the estimates. Now, to follow up on that, I fully agree that, the action agencies should be members of interagency commodity estinmate committees, because it is important to know about the action programs.

But the chairmanship should rest with the agency that has the overall responsibility for the assessment and for reporting.

Chairman HUMPHREY. Do you feel that the Crop Reporting Board and the Outlook and Situation Board perform useful functions?

Mr. HJORT. Absolutely. I think it is essential to Have a body of senior experienced people that review the estimates and approve them before they are released for public consumption.

Chairnman HUMPHREY. So you feel that a board to approve estimates of world agricultutml production and trade would be useful?

Mr. HJORT. I think it would be highly desirable.

Chairman HUMPHREY. Tomorrow we will hear from Hosea Harkness of Cook Industries. He recommends that a world crop reporting board be set up within the, USDA to review all sources of country production information, attache reports, foreign-released statistics, weather-yield analysis, check data, et cetera. Based on this, in a timely manner, the board would forecast or estimate what would be acknowledged within the Government as the best figure. Thus, we would eliminate duplicate numbers floating around the Government.

This would eventually lead to more credibility for the private user.

Do you concur in that basic suggestion?

Mr. HJORT. Yes; I think it is a very good recommendation that he has made to you and I believe that-you will note from m own statement that his recommendation fits very well with what I have recommended. I think it is essential to have a board to review these estimates before they are released.

Chairman HUMPHREY. 1)0 you recommend that senior analysts assume responsibility for issuing monthly digests of world agriculture for general distribution ?

Apparently, now, junior staff issue these reports for internal use only.

Mr. HJORT. Yes. I think here again we are circling around the same kind of question, With junior staff only involved, I don't believe the product is going to be as good as if you use senior staff and review boards and processes set up for the overall reports.

There is another weakness in the material that is being referred to, and that is because it is essentially unanalyzed information. They are reporting facts as they come to the junior analysts, but the implications of the information is not analyzed or discussed.

Chairman HUMPHREY. Dr. Wilcox, what do you think about the suggestions that have been made here for the evaluation and analysis ?

Dr. Wilcox. 1 personally am very happy that these are the kind of recommendations that are coming to you from outside the Gvernment.

Chairman HUMPHREY. Very good. We thank you very much. This will all be very helpful. As you know, we are getting down to the point where we will be making some recommendations, I think these hearings will be of considerable help.

Mr. Hjort, you feel that the ERS is a well-organized instrument of the Department, is that right ?

Mr. HJORT. I have in my main report some reorganizational alternatives. The important point, in m mind, is to have the organizations with responsibility for tile world J and national systems reporting to the Dirertor of Agricultural Economnics.

That comes out of my assessment and it comes from personal experience. I have worked very closely with every person that has ever filled that position since it was created, including one of the persons sitting in this room at the present time and including Don Paarlberg-I served with him for nearly a year after he came in.

That position, ever since being established, has been filled with a professional of high integrity. And that, to me, is the most essential point to have in any world information system.

Chairman **HUMPHREY.** Many of the smaller developing countries could certainly benefit from a more, reliable information system. The fact is, as one of the witnesses indicated, that even if the system wasn't too good in a small country with limited production and a small population, it is tile larger developing countries that really determine the major degree of accuracy of your reports.

Mr. **HJORT. Absolutely. But, of course, even in the big ones, we have unreliable or unavailable data. The Soviet Union, People's Republic of China, India—we didn't mention here and I didn't highlight it, but it is in my report again—there are certain countries that bias their estimates. They believe it to be in their interest from a political standpoint.**

Chairman HUMPHREY. Yes, we know that is a concern.

Mr. HJORT. And it another reason, then, why you have to have people of high integrity, because whoever is operating the world system has to be able to change that estimate and put in one that is unbiased.

Chairman HUMPHREY. What is your view of the FAO system that is now being developed ?

Mr. HJORT. I am very gratified by the way FAO is moving to improve their system. Their major deficiency ty far has been the lack of timeliness.

Chairman HUMPHREY. That is what I keep hearing.

Mr. HJORT. But they are moving, with their quarterly reviews and monthly updates, they are moving very well, in my mind, toward more timely information. The have a long way to o and they will have to work very hard to develop the analytic capability needed to operate their system.

But, in any event, they are moving in the right direction.

Chairman HUMPHREY. Thank you very much. We are most grateful to you. And may be tapping your brain power a couple of times more,

Mr. HJORT. Thank you.

Chairman HUMPHREY. Thank you. This concludes the first day of OTA hearing.

[The prepared statement of Mr. Hjort follows:]

STATEMENT OF HOWARD W. HJORT, JOHN SCHNITTKER ASSOCIATES

AGRICULTURAL INFORMATION SYSTEMS

Summary and Conclusions

1. World supply-demand estimates are the summation of country supply-demand estimates. Therefore, the performance of the world agricultural information system depends upon the availability and reliability of national estimates. Unfortunately, current supply-demand estimates obtained from national agricultural information systems vary from timely and reliable to nonexistent. Only the former can be used in the world system. FAO has been working with menlber governments for years to help them establish agricultural information systems and improve the reliability of agricultural statistics. These efforts must continue to be supported, but under the best of circumstances it will take years to bring all national systems to an acceptable standard. While this long-range program moves forward to generate analytic models of proven validity, the only alternative is to use timely and reliable estimates.

2. Neither USDA nor FAO possess the analytic capability to generate sufficiently timely and reliable supply-demand estimates for all commodities and countries where national systems are unreliable. In consequence, all too frequently estimates based on past trends, sometimes adjusted by judgment, are used instead of more reliable estimates from formal analytic models that take into account the full range of factors influencing the supply of and demand for agricultural products. A deeper analytic capability must be developed to improve the reliability of current world supply-demand estimates and assessments of the world situation and outlook for food and agriculture,

3. Reports received from USDA'S attache network are the primary source of foreign agricultural information for the world agricultural information system. Attaches prepare many reports and provide much information, but few are specialists in the collection or analysis of agricultural data. and these tasks are usually not perceived to be their primary mission. Frequent reposting of attaches adversely affects the quality of the information they provide. These weaknesses can be overcome by employing specialists in the collection and analysis of agricultural information who would be posted for extended periods, but this is a long-range and partial solution. The near-term solution is to require attaches to provide more precise data and information on the use of land, agricultural inputs, human and animal populations, income, prices, and other supply and demand factors so that analysts covering the world situation and outlook are in a better position to assess these factors, develop more reliable supply-demand estimates, and report more fully and frequently on the world food and agricul-

ture situation and outlook. Since inadequate analysis of available data already is a more serious constraint than inadequate data, the overall improvement of the world systems depends mainly upon how many and how effectively analysts are employed.

4. In the final analysis, objectivity is the essential attribute of an agricultural information system. The objectivity of USDA's world and national agricultural information systems is threatened, and effciency and effectiveness held far below potential by the organizational structure used to operate the systems and the manner in which the responsibilities for them are assigned. The responsibility for the world agricultural information system is shared by two officials in the Office of the Secretary and the system is operated by two completely separate agencies, one with a mission and action program responsibilities that make it unnecessarily difficult to maintain objectivity. The responsibility for reporting on the U.S. agricultural situation and outlook rests with the Economic Research Service and the Outlook and Situation Board, but the chairmanships of the U.S. supply-demand estimates committees have been given to an agency that has responsibility for administering farm programs. To protect objectivity and improve efficiency and effectiveness, the responsibility for USDA'S world and national agricultural information systems should be clearly assigned, The Director, Agricultural Economics, who already has the responsibility for the U.S. system and shares the responsibility for the world system, should be assigned the responsibility for both systems, and the agencies that report to the Director should have the sole mission of providing economic intelligence on U.S. and world agriculture. Chairmanship of interagency commodity estimates committees should be provided by the agency that has the responsibility for the estimates and assessments of the situation and outlook. Reorganization is a necessary condition to improving the efficiency and effectiveness of the agricultural information systems operated by USDA. The reorganization alternative that promises the highest efficiency and cost effectiveness is one that combines world and national commodity analysts in a manner that eliminates unnecessary duplication.

WORLD AGICULTURAL INFORMATION SYSTEM

Introduction

On August 21 I was asked by the Office of Technology Assessment (OTA) to prepare a report containing "a critical evaluation of the world agricultural information system . . ." The objective of the report is to assist in the formulation of specific subject areas to probe, and questions to be explored during the forthcoming OTA hearings on food information systems. The report concentrates on specific gaps or weaknesses in the system that can be corrected within the short run at minimum cost, especially those where corrective measures can be taken unilaterally by the United States. Other improvements that should be made but that will take longer to implement and that require cooperation from others are identified and an implementation approach outlined.

Agricultural Information Systems

A world agricultural information system must have the capacity to develop world supply-demand estimates for all agricultural commodities and be able to accurately assess and interpret their implications. Agricultural statistics and analysis are the ingredients of the system; forecasts of the outlook are the outputs.

Agricultural statistics are the raw material-the basic input—for an agricultural information system. Agricultural statistics, collected either by taking a census or sampling a population, tell us what is happening or what has happened. An agricultural census, taken once every several years, provides the benchmark for the world agricultural information system. Estimates for the current and intervening years are developed either by sample surveys or through analytic methods that use statistics and interrelationships from the past to generate current estimates. World supply-demand estimates are now being developed from a combination of sample survey data and analysis. The basic data requirements for an agricultural information system are identified and alternative procedures for developing them outlined in Appendix I.

While agricultural statistics and supply-demand estimates are essential to an agricultural information system they, alone, are of limited value, These statistics must be carefully *analyzed* by specialists who can interpret their significance. Finally, the results of their assessments must be made available to those who need to be informed about the world food and agricultural situation and outlook, and used by the policy ofiicials. The ability to analyze and interpret agricultural statistics depends upon the number of analysts, their training and experience, and the analytic techniques they employ. Since agricultural production is influenced greatly by weather patterns and is, therefore, inherently unstable, the analysts and managers of the world agricultural information system must have the time and ability to continually reassess the situation and outlook for world agriculture.

In order to operate a world agricultural information system, it is necessary to maintain historic data, have the capacity to develop and publish reliable supply-demand estimates, possess the ability to trace the implications of the current situation, and to make those implications known to the world. While there are a number of private and public organizations that operate partial world agricultural information systems, only two operate full-fledged systems-the United States Department of Agriculture (USDA) and the Food and Agriculture Organization of the United Nations (FAO). USDA and FAO collect, maintain, and publish world agricultural statistics; develop and maintain world, regional, and country supply-demand estimates for agricultural commodities; continually analyze the supply-demand balances and the factors or events influencing supply and demand; and release reports containing the results of their assessments of the current situation, near-term and longer range outlook for food and agriculture. Both USDA and FAO depend heavily upon national agricultural information systems of varying sophistication and reliability, but both have the analytic capability to develop current supply-demand estimates in those situations where the national agricultural information systems fail to generate timely or reliable estimates. USDA and FAO draw upon sources outside their own system for agricultural information and intelligence.

Evacuation Criteria

The factors that must be taken into account in developing judgments about the relative strengths and weaknesses of a world agricultural information system are objectivity, reliability, timeliness, adequacy in terms of coverage, efficiency, and effectiveness. The ideal is a system that provides users timely, unbiased interpretations of the current situation and outlook based upon estimates of known reliability for all commodities and countries through the use of the most cost effective procedures known to mankind.

Objectivity

Objectivity is the essential attribute of an agricultural information system, and the most difficult to ensure or measure. To be useful, the products of the system must be as free of bias as the state of the art will permit. Users must be convinced that the results are not tempered to prevent an outcome that is more or less favorable than is the real situation. In theory, the objectiveness of a system can be measured by comparing supply-demand estimates with the final outcome after adjusting the latter for changes in the estimates due to events that took place after the estimates had been prepared. In practice, it is extremely difficult to make such measurements. There are guidelines, however, that can be followed to help ensure objectivity. Objectivity is more likely to be obtained when the organization with responsibility for the information system has the operation of the system as its sole mission. Suspicions about objectivity automatically arise whenever an organization that has multiple missions or action program responsibilities also has the responsibility for operating the agricultural information system. The temptation to modify estimates is ever present, and some estimates are always biased for political purposes. In this circumstance, the organization operating a world agricultural information system must reject the biased estimate in order to maintain the integrity of the system. In order to protect the system, the responsibility for it should be assigned to an organization that has no other responsibilities and that is directed. administered, and operated by persons of high integrity.

Reliability

The reliability of an agricultural information system refers to the confidence that one can have in the supply-demand estimates developed within the system. It is easy to confuse the terms objectivity and reliability. In simple language, objectivity means to tell it like it is, while reliability means to find out what the situation is and what it is likely to be. The reliability of the estimates is indicated why the methods used to develop them. Those of known statistical reliability developed from a representative sample of a population and those from analytic models of proven validity are superior to estimates developed from non-representative samples or from samples drawn from unknown populations, or through the use of untested or weak analytic techniques. Some national agricultural information systems develop and release current supply-demand estimates that can be relied upon by those operating worldwide systems; others generate current estimates of unknown statistical reliability that must be subjected to consistency checks before being used in the world system. Some countries never develop or release current estimates, so those operating the world system must use analytic techniques to develop the necessary estimates. Finally, some national systems are essentially without capability to generate agricultural statistics, which means those operating the world system must rely entirely upon analysis of factors influencing supply and demand for current estimates. The reliability of a system can be indicated by comparing estimates with final results.

Timenliness

Timeliness refers to the time that lapses between receipt and release of agricultural information, A system that can assess and report the implications of a changing situation days after the change becomes known is more useful than one that takes weeks or months. A system that releases unanalyzed information immediately upon receipt is more effective than one that delays release. A system that generates an estimate of, say, crop production ten days after data were collected from farmers is more timely and effective than one that takes thirty days to prepare the estimate for release. The timeliness of the national agricultural information systems is extremely variable. USDA's national system is without parallel in this regard in that estimates are released after a lapse of as few as ten days. There are others that do not even bother to collect agricultural statistics until after the season has ended. In order to provide timely information, therefore, those operating world agricultural information systems must be prepared to develop and release their own estimates.

Adequacy

The adequacy of a system refers to the scope and uniformity of coverage. A system that provides detailed coverage of the crops, but superficially covers livestock is less adequate than a system that provides uniform coverage of both crops and livestock. Similarly, a system that provides detailed coverage of agricultural production, but fails to adequately cover consumption is inadequate. Further, a system that covers some countries, but fails to cover others, is inadequate.

Efficiency and Effectivenesss

Efficiency and effectiveness can be judged by determining if obsolete data are being collected, reviewing the methods used to collect and analyze data, the number and qualifications of analysts employed in operating the system, the number of organizational units involved in collecting and analyzing agricultural data, and the organizational structure used to operate the system. Collecting obsolete data is, at best, a waste of money and can lead to inappropriate and misleading conclusions. Reliable estimates can be generated by sampling a relatively small proportion of a population, a procedure much more cost effective than drawing larger than necessary samples. Sophisticated analytic models and computers can systematically handle more variables, but they cost more than less sophisticated techniques. The task is to use the analytic technique that generates reliable results at minimum cost. Too few analysts keeps the system's efficiency low, as does too many. A system operated by well trained, experienced analysts and statisticians will be more cost effective than one operated by poorly trained or inexperienced employees. Efficient use of manpower and cost effectiveness of the system are influenced by the organizational structure. When the responsibility for the system rests with a single organizational unit, efficiency and cost effectiveness are highest, all else being equal.

General Comparison of USDA's and FAO's Systems

USDA's world agricultural information system is backed by a larger field staff and has been providing information more timely than FAO'S. The statistical reliability of supply estimates appears to be about the same, in part because they both rely heavily upon national systems, but USDA releases eatimates and assessments more frequently. FAO allocates more resources to improving national data collection and processing capabilities than USDA. FAO provides compre hensive coverage of agriculture, including forestry and fisheries, and is the major source of comprehensive historical agricultural statistics. FAO seems to probe more deeply into factors influencing the situation and outlook for world food and agriculture, but takes more time to do so and tends to limit coverage to specific issues. Both USDA and FAO are relatively weak in assessing current consumption requirements. Serious efforts are king made both by USDA and FAO to improve their systems. Both have given increased attention to the num*ber* and frequency of reports and FAO is in the process of augmenting staff to handle the broader responsibilities assigned them after the World Food Conference of last November. While they both have increased the number and frequeney of reports on various aspects of world agriculture, most of the additional information from USDA'S system is data for analysis instead of the results of analysis.

Inadequate analysis appears to be a more effective constraint on both systems than inadequate data. FAO'S mission and organizational structure suggest it is easier for them to maintain objectivity, and to make more progress in improving the reliabilty of agricultural statistics collected through various national systems. The major weakness in the FAO system has been the inability to provide information on a timely basis. This weakness is being overcome by the series of monthly and quarterly reports now being released. FAO'S system is constrained by a serious lack of qualified analysts, especially in view of the additional tasks they were assigned last fall. The field staff is extremely limited and data from non-member countries difficult to obtain. However, they now obtain reports prepared by the U.S. agricultural attaches to augment reports from traditional sources. FAO does have a sensitive problem when it becomes necessary to adjust member government estimates that have been biased for political purposes, but they can and do substitute their own estimate for the "official" estimate when necessary. All in all, USDA'S system clearly has been superior with respect to timely assessments of the current situation and near-term outlook, but unless steps are taken soon to improve USDA's system, the most reliable system will he the one operated by FAO.

USDA's World Agricultural Information System

Responsibilitiy for the System

USDA operates a national and a world agricultural information system; here our focus is upon the world system. The rationale for USDA's world agricultural information system has never been clearly specified. In consequence, no one person, office, or agency has the responsibility for operating USDA's world agricultural information system. Presently, the responsibility for the system rests with two USDA agencies-the Foreign Agricultural Service (FAS) and the Economic Research Service (ERS). FAS'S agricultural attache network provides foreign agricultural statistics and intelligence and the Foreign Commodity Analysis Unit maintains, analyzes and Publishes world agricultural stitistics and reports on the situation and outlook for major commodities. ERS'S Foreign Demand and Competition Division reports their assessment of the world and regional agricultural situation and outlook, The Administrator of FAS reports to the Assistant Secretary for International Affairs and Commodity Programs, while the Administrator of ERS reports to the Director of Agricultural Economics. The Assistant Secretary and the Director both report to the Secretary of Agriculture.

The mission of FAS "is to expand foreign markets for U.S. farm commodities." In support of that mission, FAS administers commercial export, food assistance, and foreign market development programs, participates in the development of agricultural trade policy, and collects, analyzes, and disseminates information on foreign agriculture. Agricultural attaches located in most major agriculturally important countries have, along with other duties, responsibility for reporting information of importance to local and U.S. agriculture.

Collecting Foreign Agrircultural Information

Reports from the attaches are the heart of USDA'S world agricultural information system. They are scheduled, coverage specified, and reporting procedures standardized by officials in Washington. The reports include assessments of the overall agricultural situation and the factors influencing production, consumption, and trade such as prices, price and non-price policies and programs, and input supply availabilities. Monthly highlight reports provide updates to previous reports. Quarterly (grains for example), semi-annual (fats and oils for example), or annual (agricultural situation for example) reports are prepared on various aspects of the agricultural situation and outlook. Faster means are used to report events of major significance.

The *objectivity* of the estimates transmitted by the attache depends upon the objectiveness of the estimates released by the host government and the the attache. When governments believe it to be in their vested interest to release biased estimates, the attaches report the "official" estimates but make their own when they have reason to believe the estimate is biased. Sometimes attache estimates are biased in the opposite direction, requiring consistency checks by analysts in Washington.

The rliability of the estimates attaches transmit is a function of the methods used to collect agricultural statistics and to assess them. The reliability of estimates from national agricultural information systems varies significantly from one country to another, as previously indicated. When the host country fails to collect or publish agricultural statistics, the attache is required to develop them. When estimates of known reliability are available *on* a timely basis, the attache's task is relatively simple-till he need Do is transmit them along with brief explanatory notes. Estimates of questionable reliability must be subjected to consistency criteria and modified to make them internally consistent, either by the attache or the analytic staff in Washington. When estimates are not available, the alternatives are to conduct a judgmental type survey or use analytic models that have been verified by comparing model estimates with actual historic results to develop the necessary estimates. In general, the attaches submit estimates based upon their own and local staff's judgment, after reviewing the estimates with others on the scene. The reliability of the estimates transmitted by the attaches from countries who fail to provide reliable current estimates depends heavily upon their judgment, a function of experience, interest, analytic capability. and the importance they attach to the task of developing estimates. These attributes obviously vary significantly from one attache to another, but in general are influenced by what they perceive to be their mission and the length of time they are posted in a country. Few attaches perceive the collection of agricultural statistics and the development of supply demand estimates to be their primary mission; instead, just as is the case for FAS, the attache's primary mission is to expand foreign markets for U.S. farm commodities. The task of developing numbers and drafting reports is usually assigned to assistants or local staff, many of whom are more familiar with the data anyway. Attaches seldom are selected for their analytic capability ; instead, it is their ability to represent U.S. agriculture that is the guiding criteria. Relatively short tours of duty may be advisable in the larger picture, but is a distinct disadvantage with respect to the development of reliable estimates.

Timeliness of agricultural intelligence depends upon directives from Washington, the initiative of the attache, and the ability of national systems to generate timely information. As previously indicated, there are a number of countries where estimates are never released in a timely manner. Most national systems rank poorly in terms of timeliness. Attaches must submit supply-demand estimates when scheduled and, therefore. frequently send "post" estimates. Attaches cable information of significance immediately.

The scope of the intelligence system operated by the attaches is broad, but *adequacy is* impaired by the lark of uniformity of coverage, both in terms of content and geography. Various efforts are under way to improve adequacy by requesting attaches to give greater attention to the factors that are or will influence supply-demand balances for agricultural products. Their discussion of the factors that influenee production and supply tend to be more complete and frequent than on the factors Influencing the demand for agricultural products. Analyses of these factors by attaches or their staff are based upon extremely simple analytic techniques or pure judgment, instead of formal models that generate results of known reliability. The adequacy of the intelligence system operated by the attaches is held below potential due to inadequate coverage of several important agricultural countries. The most notable gap is the lack of an attache in the People's Republic of China, but the intelligence gathering in many centrally planned economies is weak to nonexistent,

The efficiency and effectiveness of the intelligence system operated by the attaches is lower than it would be if specialists in data collection and analysis with no other duties were located in the country and if they were part of an organization whose sole mission was to operate a world agricultural information system.

Assessing *and Disseminating Information*

FAS'S Foreign Commodity Analysis Unit and ERS'S Foreign Demand and Competition Division share the responsibility for analyzing and disseminating information on world agriculture. Both rely manly upon attache reports but obtain intelligence from numerous other sources, including the Central Intelligence Agency.

FAS publishes world agricultural production and trade estimates for agricultural commodities, releases revised foreign estimates weekly, prepares reports on developments of importance to world agriculture, publishes a series of circulars that contain assessments of the current situation and near-term outlook for major groups of commodities such as the grains or fats and oils, and maintains historic supply-demand estimates for selected commodities.

ERS conducts a program of research and analysis that results in reports contatining assessments of the current world and regional agricultural situation and near-term outlook, the longer range outlook for world agriculture, and the implications of changes in the international monetary situation, world agriculture and trade policies, and economic development and trade patterns. ERS also monitors and publishes foreign agricultural trade statistics of the United States.

Since the basic source of data for analysis is the same for both FAS's and ERS's analytic units, improvements in the objectivity, reliability, timeliness, and adequacy of the information released by them depend upon the other sources of intelligence they draw upon, their own analytic capability, and the consistency checks they employ prior to releasing information and reports. Estimates from the field are subjected to consistency checks, using data from prior years to improve reliability, and in some cases estimates are developed by the analysts using analytic models that have generated reasonably reliable results in prior years. For example, estimtites of grain production for the Soviet Union are developed by specialists in the Foreign Demand and Competition Division of the Economic Research Service. FAS's analysts rely more upon simple consistency checks, experience, judgment, and trend analyses than upon models or sophisticated techniques of analysis in checking or developing estimates. They do not conduct indepth analyses or issues of factors influencing supply and demand. The FAS analyst is a commodity specialist. The ERS analyst is a country specialist. ERS is more research oriented than FAS. ERS's analysts have received deeper training in research methodology and have more experience in the use of sophisticated analytic techniques and models, They conduct the in-depth analyses of issues and factors influencing supply and demand. ERS is the source of agricultural intelligence; FAS tile source of agricultural statistics and commodity information. In recent months the flow of unanalyzed data from 17 USDA'S system has increased significantly, much more than the increase in reports containing carefully reasoned assessments of the current situation and outlook.

ERS's world and regional agricultural situation and outlook reports are approved by the Outlook and Situation Board; FAS's reports on the world situation and outlook for the various commodities are not, Attempts to ensure objectivity and reliability are more evident with respect to the world agricultural information developed and released by ERS than is the case for the information developed and released by FAS.

Weakness in USDA's Systems and Means of Overcoming Them

Weaknesses Due to Poor National Systems

The supply-demand estimates produced by a few national agricultural information systems lack objectivity. To prevent this problem from impairing the objectivity of USDA's system. USDA's analysts must develop a deeper capacity to generate unbiased estimates for the country of concern and those managing the USDA world system must be prepared to defend the revised estimates.

The supply-demand estimates produced by national agricultural information systems vary greatly in reliability, timeliness, and adequacy. To prevent this variation from keeping the reliability, timeliness, and adequacy of USDA's world system below potential, there are two alternatives: provide additional technical and financial assistance to help improve *national* agricultural information systems with respect to these attributes, or strengthen the analytic component of USDA's world system so that more reliable and timely national estimates can be generated within the system. Both approaches must be pursued, but the former

will take longer to accomplish than the latter. In the near-term, the @y alternative is to improve the analytic capability of USDA's world system.

When countries fail to provide current supply-demand estimates, the only alternative is for USDA's analysts to develop reliable estimates through the use of analytic techniques. The longer-range solution is to encourage and assist these countries in the development of a reliable national agricultural information system.

Weaknesses Due to Collecting Inadequate Data

For various reasons, the reliability of the supply-demand estimates forwarded by attaches varies significantly. In addition to the problems with national systems previously discussed, reliability is reduced due to the low priority given the development of estimates by some attaches, the lack of knowledge about the country due to frequent reposting, and inadequate training or interest in the use of analytic techniques. In order to keep these problems from holding the reliability of the system's estimates **below standard, there are two broad choices: *replace* the attaches with specialists in collecting and analyzing agricultural statistics, or requiring attaches to submit more precise statistics and information on the factors that determine production, supply, consumption requirements, and trade according to standardized formats so that the analysts in Washington can develop more reliable estimates. The latter is the alternative being pursued and must continue to be relied upon for the near-term. It must be pursued more vigorously.**

Weaknesses in Analytic Component

The analysts in FAS rely almost exclusively on experience, judgment, and trend analyses in making initial forecasts of supply-demand balances for the commodities. As we have learned in recent years, trend analyses fail to provide reliable results. More detailed analyses of the factors that determine production and consumption are required to improve the reliability of USDA's world estimates.

There is a clear imbalance in USDA's system—more data for analysis are being provided from the field and other sources than are being adequately analyzed. In part, this imbalance stems from insufficiently precise data; in part, due to **an inadequate analytic capability; and is partially a function of the organizational structure USDA uses to operate the world system. There is need for more precise reporting from the field on the input situations and outlook, and on the factors influencing consumption requirements. These field reports *must* be standardized as the data are the raw material for analysis and reports from USDA. Better data from the field is a necessary prerequisite to better reports from USDA on the farm input situation and outlook and on consumption requirements, but unless USDA possesses a deeper analytic capability and uses analysts more efficiently and effectively than now, better field data will be largely wasted. The present imbalance can only be corrected by reorganizing and by augmenting the analytic staff as necessary.**

Weaknesses Due to Organizational Structure

The organizational structure used by USDA to operate the world agricultural information system impedes efficiency and effectiveness. It is extremely difficult to use analysts efficiently and effectively when the responsibility for the outputs of a system is assigned to two completely separate agencies.

Permitting the responsibility for the world agricultural information system to be shared by two different agencies, one with a mission, policy, and program responsibilities that makes it unnecessarily difficult to ensure objectivity, weakens the system appreciably. The mission of FAS is to expand foreign markets for U.S. farm commodities. The mission of ERS is to develop and carry out a program of economic research designed to provide economic intelligence for users. FAS has responsibility for administering action programs; ERS does not. The mission of FAS, and the vested interest that FAS thereby has in U.S. and world estimates, makes it difficult for those in the Foreign Commodity Analysis Unit or the attaches to maintain objectivity with respect to assessments of the world situation and outlook. It will be essentially impossible for USDA's world agricultural information system to reach potential under the present organizational setup.

In order to improve the efficiency, effectiveness, and objectivity of USDA's world agricultural information system, the responsibility for it must be clearly assigned. Using these criteria, the position of Director, Agricultural Economics is the logical choice for the assignment. The Director would then have the overall

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responsibility for both the world and national agricultural information systems operated by USDA ERS, the agency with responsibility for reporting on the situation and outlook for U.S. agriculture, and the Statistical Reporting Service (SRS), the agency with responsibilities for collecting, processing, and publishing U.S. agricultural statistics, report to the Director of Agricultural Economics. Further, the Economic Research Service shares the responsibility for the operation of USDA's world agricultural information system. The Director, therefore, already has the responsibility for the national agricultural information system and shares the responsibility for the world system. Third, the position of Director has been filled, ever since being established, with a professional agriculturalist of high integrity, a necessary condition for objectivity.

There are alternative means of accomplishing the necessary reorganization. One would be simply to transfer the Foreign Commodity Analysis Unit from FAS to ERS and make it another division of that agency. Another would be to combine the Foreign Commodity Analysis Unit from FAS with the Foreign Demand and Competition Division from ERS into a new agency, one with the sole mission of providing economic intelligence on world agriculture. The third alternative would be to combine the foreign commodity analysts from FAS with the U.S. commodity analysts from ERS and the foreign and national analysts from ERS into a single economic intelligence agency with responsibility for assessing and disseminating information on world and U.S. agriculture.

Objectivity criteria would be satisfied under either reorganization alternative. Overall efficiency and effectiveness would be highest under the third alternative, next highest under the second, and lowest under the first alternative. It would be higher, however, under the first alternative than at present, simply because it would become possible for the first time for a single agency to plan and carry out a coordinated program of analysis. Efficiency and effectiveness would be higher under alternative two because the system's operation would be directed by more senior professionals. The third alternative promises the highest efficiency and effectiveness. It provides the opportunity to eliminate the duplication associated with the operation of two systems. It is not necessary to have one group of commodity analysts for the world and another for the U.S. The U.S. analyst cannot perform his duties unless he takes the world situation and outlook into account; the world analyst cannot performhis duties unless he takes the U.S. situation and outlook into account. Efficiency and effectiveness would obviously be improved by combining the knowledge of these analysts.

Under either reorganization alternative, the responsibility for collecting foreign agricultural information would have to remain with FAS's attaches until arrangements can be made to relieve them of the responsibility by employing and posting specialists in the collection and analysis of agricultural statistics. But the responsibility for the content, frequency, and format of attache reports would have to be assigned to the agency with responsibility for operating the world agricultural information system. As soon as feasible, a separate agency under the Director's guidance should be created, or the responsibility for collecting, processing, and publishing world agricultural statistics should be assigned to the Statistical Reporting Service.

SRS is among the premier agencies in the world with responsibility for collecting, processing, and reporting agricultural' statistics. It is the world's best with respect to timeliness, and among the very best with respect to statistical reliability of the results. SRS is a professional organization whose sole mission is to collect, process, and report agricultural statistics. They never attempt to interpret the *results;* they do run elaborate consistency checks before the results are released they are constantly trying to improve methodology; and the security procedures they employ are exceptional. In short they take their mission seriously and constantly strive to improve the quality of the information they generate. They must be relied upon for at least advising those with responsibility for collecting statistics to be used in USDA's world system.

As previously indicated, it is necessary to develop a deeper capability for analysis of the factors influencing world agriculture. It may be necessary to employ additional analysts, but doing so and using them inefficiently, the present approach toward improving the world and national agricultural information systems. is not a cost effective solution to the problem; reorganizing is. It may be necessary to increase the number of analysts and field staff of the new or augmented agency, but the potential from reorganization must be tapped first. The need for developing, verifying, and using more sophisticated analytic techniques is evident, but this need not increase the number of analysts. Instead. the task is to make more effective use of the analysts and positions now available.

Weakness in USDA's National Agricultural Information System

This report has focused on USDA'S world agricultural information system. There is, however, a serious flaw in the *national* agricultural *information* system operated by USDA. The responsibility for outlook and situation reports rests with ERS and the Outlook and Situation Board, but the authority for U.S. commodity supply-demand estimates is outside ERS. The reliability of the U.S. agricultural information system is, as a result, seriously impaired. U.S. supply-demand estimates are developed by Interagency Commodity Estimates Committees (ICEC) chaired by the Agricultural Stabilizatition and Conservation Service. Members of the committees are drawn from the Economic Research Service and the Fore&n Agricultural Service. Responsibility for foreign trade estimates rests with the member from the Foreign Agricultural Service; the responsibility for domestic estimates rests with the representative from the EconomicResearch Service. The Agricultural Stabilization and Conservation Service has the responsibility for administering price support programs for farmers, and the Foreign Agricultural Service has responsibilities for administering export expansion programs. Both, therefore, have a vested interest in L'. S supply -demand estimates. USDA's Outlook and Situation Board approves outlook and situation reports on U.S. agriculture, but the ICEC'S supply-demand estimates are taken as given by the Board. USDA'S supply-demand estimates for the United States have been wide of the mark in recent years. While both domestic and foreign demand estimates have been in error, the magnitude of the error in the export estimate has been much larger, either due to changes in the basic situation, faulty analysis, or bias. Investigations of the reasons for errors in the estimates have centered upon ERS, the agency with responsibility for the estimates but without authority. This flaw must be corrected. It is necessary to take program operations into account, when developing supply-demand estimates but the responsibility for the estimates must rest with the agency with responsibility for them. That is, the Chairmanship of the ICEC's should be assigned the agency with responsibility for operating the agricultural information system and the members should he drawn from the agencies with responsibilities for programs that have an impact on supplies or demand.

The creation of an economic intelligence agency, and combining commodity analysts from FAS and ERS into *one unit* provides the opportunity for improving reliability of U.S. supply-demand estimates, but this major flaw in USDA's national agricultural information system will continue to impair reliability unless the Chairmanship of the ICEC's is taken from ASCS.

Longer-Range Improvements That Require Cooperation

FAO has concentrated on improving the quality of agricultural statistics through standardization of census procedures and the use of proven statistical methodology in developing estimates from samples. FAS has not been able to help host governments improve the statistical reliability of their agricultural statistics and estimates. The United States has an interest in relialble agricultural statistics and the world agricultural information system operated by USDA has its effectiveness reduced and costs increased by unreliable statistics and estimates and the lack of data. The United States should provide financial support to FAO'S program of improving agricultural statistics. The alternative is to encourage the Statistical Reporting Service and the Economic Research Service to develop an expanded technical assistance program for, respectively, the collection and analysis of agricultural statistics.

Note on Recommendations Contained in Report of the Food Advisory Committee

I am in full agreement with recommendation three, on eliminating obsolescence in food and fiber data series. Maintaining obsolate data series is wasteful. Analyzing obsolete data is, at best, unproductive, and is of negative benefit when reliance on obsolescent data leads to inappropriate conclusions. For these reasons the place to start improving the national system is by removing excess and outdated information prior to overloading the system with additional data.

Recommendation four, on the integration of staff and activities of the Agricultural Census and the Statistical Reporting Service, has considerable merit, but probably should be broadened to include data collection activities in addition to the Census. The Statistical Reporting Service, in my view, is the premier government data collection and processing agency. They obtain high marks with respect to reliability and the high&4 marks with respect to bliness. I am convinced SRS could significantly reduce the time lag between collation and release of agricultural data now being collected by the Census Bureau.

The situation with respect to the fertilized information system is an example of how difficult simple tasks can be made. We find it far easier to obtain reliable information on fertiliser stocks, production, supplies, prices and consumption for India or Pakistan than we do for the United States. Obviously, I support recommendation five.

For reasons given in the report, I am in full support of recommendation ten, concerning assistance for FAO information activities, and especially recommendation twelve, providing for increased technical assistance to improve agricultural information systems in the developing countries.

APPENDIX I

AGRICULTURAL INFORMATION SYSTEM

BASIC REQUIREMENTS AND ALTERNATE **PROCEDURES**

I. Land Use Pattern:
- **A. Area used to produce crops:**
  - **1. Cropped area.**
  - **2. Idle/fallow area.**
- **B. Area used to produce livestock.**
- **C. Nonagricultural area.**

II. Crops:
- **A. Crop Production:**
  - **1. Area planted to each crop:**
    - **a. Sample survey.**
    - **b. Analysis of factors influencing plantings:**
      - **i. Area available for crops.**
      - **ii. Policies of goverments.**
      - **iii. Price relationships between various crops and between inputs and outputs.**
      - **iv. Input supply availabilities.**
    - **c. Area for harvest.**
  - **2. Yield per unit:**
    - **a. Objective yield survey.**
    - **b. Judgmental yield survey.**
    - **c. Analysis of factors influencing yields:**
      - **i. Quantities of inputs applied and their relationship to yield.**
      - **ii. Weather patterns.**
  - **3. Production estimate (area times yield).**
- **B. Stocks:**
  - **1. Old crop stocks at beginning of crop year:**
    - **b. Analysis of supply-demand factors.**
  - **2. Old crop stocks remaining at end of crop year.**
- **C. Consumption requirements:**
  - **1. Food use:**
    - **a. Food consumption surveys.**
    - **b. Food processing industry surveys.**
    - **c. Analysis of factors influencing demand for food:**
      - **i. Growth in population.**
      - **ii. Change in income and its distribution.**
      - **iii. Change in product price and its relationship to prices of substitute foods.**
      - **iv. Government policies and programs--food distribution and regulations.**

2. Feed use:
   a. Feed user surveys.
   b. Feed processing industry surveys.
   c. Surveys of stocks.
   d. Analysis of factors influencing demand for feed:
      i. Demand for animal products (population, prices, policies, and programs).
      ii. Animal units to be fed.
      iii. Price relationships between livestock product prices and feed prices.
      iv. Price relationships between feeds.
3. Industrial use:
   a. Survey data.
   b. Analysis of factors influencing industrial demand.
4. Seed use:
   a. Estimate of area to be planted in subsequent year.

D. Exports or imports:
1. Export availability or import requirement:
   a. Beginning stocks plus production less consumption and ending stocks requirement.
2. Exports or imports:
   a. World supply-demand-price prospects for crop of concern and for substitutes.

111. Livestock:

A. Introduction:
1. Number of animals by class of livestock:
   a. Sample survey or census.
   b. Analysis of factors influencing animal population:
      i. Government policies and programs.
      ii. Area available for livestock.
      iii. Price relationships between various classes of livestock.
      iv. input-output price relationships and returns prospects.
2. Production per animal:
   a. Sample survey.
   b. Analysis of factors influencing productivity:
      i. Slaughter weight and carcass yield.
      ii. Feed conversion ratios,
      iii. Weather patterns.
      iv. Supply of feeds.
3. Production estimates:
   a. Meat production (number slaughtered times carcass yield).
   b. If ilk. eggs, etc., production (production units times per unit yield).

B. Stocks:
1. Beginning of year:
   a. Survey.
   b. Analysis of supply-demand.
2. End of year:
   a. Analysis of supply-demand.
   b. Policy considerations.

C. Consumption requirements:
1. Food use:
   a. Food consumption surveys.
   b. Processing Industry data.
   c. Analysis of factors influencing food use (same as II. C. 1. c. i-iv above).
2. Industrial use:
   a. and b. (Same as II. C. 3. a. and b. above.)

D. Exports or imports (same as II. D. above).

Chairman HUMPHREY. Mrs. Holt, a member of the Technology Assessment Board has a prepared statement she would like to insert.

[The statement follow:]

STATEMENT OF HON. MABJORIE S. HOLT, REPRESENTATIVE IN CONGRESS FROM THE FOURTH CONGRESSIONAL DISTRICT OF MARYLAND

Mr. Chairman, I appreciate the opportunity to present my views on the report entitled "Food, Agriculture and Nutrition." I intend to make my remarks as concise and as precise as possible.

My basic observation is that while the report contains some positive and workable suggestions, it is very weak in other areas.

Let's start with the positive side.

The recommendation on page 20 to move toward the "modernization, coordination and standardization of older food and fiber data" seems to me to be a good one.

If there is anything that we have now as legislators, it is too *much* information. Reams and reams of reports come to us every day. Most of this material goes unread and eventually is discarded. The basic problem is not having enough information; it is having enough useful information.

Therefore, I believe the present "information industry" both within and outside government would more fully serve itself and those it professes to assist by beginning to ask itself just how much of what it generates is really useful and relevant.

I hope also that these hearings will direct more effort toward mining the existing mountains of informational literature, rather than generating additional volumes of what is basically irrelevant trivia that only confuses, in the words of the report on page 14, "busy members of Congress who are not familiar with many food, agricultural and nutritional issues".

A second constructive idea in the report discussed at page 21 is the merger of the Agricultural Census with the Statistical Reporting Service of USDA.

I would point out that this effort was attempted several years ago by the Administration, but it was blocked by Congress in Public Law 93-80, the Omnibus Farm Bill of 1973. I hope therefore that our colleagues will now take to heart this suggestion.

Another good idea is the suggestion on page 24 to improve our use of satellite and other new technologies. The LACIE program promises to be very useful in measuring crop output throughout the world and should be most beneficial to all concerned.

Now, some negative aspects of this report:

In its general thrust the report seems to concentrate on one word . . . and that word is "MORE." It calls for—

More expenditures on information systems;
More staff in the Congress and in the Executive Branch;
More foreign aid; and
More paperwork.

As I mentioned earlier, I would hope we would be able to use what is already in the Department of Agriculture and related agencies of the Executive Branch more efficiently rather than to go off on new tangents. The same is true of the Congressional Committee staffs, all of which are ballooning in size already. The last thing we need to do, it seems to me, is to expand them further.

I also question whether OTA should get itself in the position of telling the various committees of the Congress how to organize their internal affairs anyway.

On the foreign side of the equation the United States now pays 25 percent *of* the (lost of operating the Food and Agriculture Organization of the United Nations. That is one reason why I disagree with the recommendations on page 10 and page 36 for the United States to increase its contribution to FAO which, as everyone knows, is basically a statistics-gathering organization. I think it's about time some of the other 130 countries of the world contribute a little more to the UN and its operation anyway.

My final criticism lies with the thrust of the report which is aimed at a so-called " National Food Policy."

To start off, the evidence cited in the report for such an effort is at best meager.

On page 11 the report blandly states that the "need" was reemphasized in hearings held by Senator McGovern's Nutrition Committee in June 1974.

It would be interesting to know who the witnesses were who established this "need", wouldn't it?

But regardless of who they were, I don't believe the OTA should embrace such a radical policy without arriving at its own independent decision. And I would like to state that OTA again appears to be making recommendations contrary to its legislative authority.

I note also from a Washington Post news story that Herbert Stein, the former chairman of the Council of Economic Advisors, pointed out last week to the Joint Economic Committee that "National economic planning could tend to change the operation of government and the economic system away from the interests of efficiency and democracy."

Stein said the bill would likely result in more inflationary policies that would do nothing to solve the problems of unemployment and commodity shortages.

"I don't think the bill will be passed, and I suspect the sponsors don't either," he said. "1 see it more as an educational platform."

I would only add the observation that one, if not the single most important, reason that Russia buys wheat from us is because of that nation's dedication to central economic planning on grain.

I hope we don't embrace that *same* economic philosophy, because if we do there won't be *anyone* around from whom to buy grain.

In summary, Mr. Chairman, I urge that this report not go forward unchallenged, Instead, it should be noted for its positive aspects, and then be stored in that mountain of curious but basically irrelevant literature that already overwhelms us all.

[The hearing was adjourned at 5 :20 p.m., to reconvene at 2:30 p.m., September 25, 1975.]

FOOD INFORMATION SYSTEMS

THURSDAY, SEPTEMBER 25, 1975

CONGRESS OF THE UNITED STATES,
TECHNOLOGY ASSESSMENT BOARD,
OFFICE OF TECHNOLOGY ASSESSMENT,
Washington, D.C.

The Technology Assessment Board met at 2:30 p.m., pursuant to notice, in room 324, Russell Senate office Building, Hon. Hubert H. Humphrey (member, Technology Assessment Board) presiding.

Present: Senator Humphrey.

Staff present: Mr. Emdio Q. Daddario, director; Mr. Daniel V. De Simone, deputy director; Mr. J. B. Cordaro, food program manager; Dr. Walter W. Wilcox, consultant; Ms. Ellen Terpstra, research associate; Ms. Ann Woodbridge, administrative assistant.

Chairman HUMPHREY. Good afternoon, gentlemen.

I see we have my friend, Don Paarlberg here with us today. We are anxious to hear from you.

Dr. Paarlberg, you know what the purpose of our hearing is, namely to look at the system of agriculture information gathering and analysis.

Dr. PAARLBERG. Right.

Chairman HUMPHREY. We had a productive hearing yesterday and we gained a good deal of information from our witnesses. Today, we have a number of representatives of USDA.

Dr. Paarlberg, you are Director of Agricultural Economics. Yesterday one of our witnesses indicated to us that it would be most helpful to have the entire information service of our Department of Agriculture under the overall supervision of the Economic Research Service of the Department of Agriculture.

You have a prepared statement which will be made part of the record. Would you please go ahead and summarize it for us.

Dr. PAARLBERG. Well, I'll just talk to you from the statament, Senator Humphrey.

Chairman HUMPHREY. All right.

STATEMENT OF DR. DON PAARLBERG, DIRECTOR, AGRICULTURAL ECONOMICS, U.S. DEPARTMENT OF AGRICULTURE

Dr. PAARLBERG. First of all, I would like to introduce some of our men from the Economic Research service who are here; John Stovall and Gaylord Worden, and Bill Gusser, and Dave Hume will introduce some of his people when you hear from him.

Chairman HUMPHREY. Fine.

Dr. PAARLBERG. In my statement, Senator Humphrey, I am commenting on a number of the major recommendations in the study.

Chairman HUMPHREY. Yes; this is the draft proposal that we have.

Dr. PAARLBERG. Quite so. And I will comment just very briefly and then follow whatever particular interest you may have.

Chairman HUMPHREY. Fine.

Dr. PAARBERG. Now, the first two recommendations in this draft report have to do with providing better analytical capability for the Congress with regard to information and statistical services, and we support the idea, of course. The analytical capability of the Congress should be enhanced and we will work with the congress in any effort directed to that end.

The second major topic in the report has to do with the problem of obsolete data series; and the point made there is well taken. Agriculture changes rapidly and it is important to keep our statistical series updated, and some of them are frankly a bit out of date.

We have had the review committees come in and work with us on this from the American Agricultural Economic Association, and the American Statistical Association. We have reviewed several of our specific series, particularly the farm income series. We are updating the definition of a farm which I think will bring us more current with regard to the present nature of the farm. We have worked with the Bureau of Census on that.

The third, major topic, Senator Humphrey, has to do with the timeliness and the reliability of data, and in this recommendation the question is raised regarding the agricultural census.

Chairman HUMPHREY. Yes.

Dr. PAARLBERG. Including the possible transfer of that function from the Bureau of Census to the statistical reporting service. Now, we consider the agricultural census enormously important, and we frankly feel that it has not been given the importance that it deserves in the Bureau of Census, and there has been much delay in coming out with the data.

Chairman HUMPHREY. Do you work on the questions for the agricultural census ?

Dr. PAARLBERG. Yes; we do.

Chairman HUMPHREY. In other words, you have professional input with the Census Bureau?

Dr. PAARLBERG. Yes; we do.

Chairman HUMPHREY. As you know, we receive a number of complaints from farmers out home on this. They're concerned about this probing into their private affairs, because you ask questions as to the size of the farm, the value, and all that sort, of thing. In fact, this was a topic of considerable discussion in our legislature in the State of Minnesota, and I believe they passed some resolution concerning it. I'm not positive, I know there was a resolution to call upon the Census Bureau to do away with that kind of question. But you look upon it as a vital part of the economic and social data that you need?

Dr. PAARLBERG. Yes; we do. We think that it could be improved and could be made more timely, and the questionnaires could be made more brief if they were targeted at the particular groups that must respond. We think it would be possible to update the techniques and use a probability sampling technique.

We are not ambitious to take over that service. If the Census could be given greater importance, and brought out more quickly, we would be very happy to see it stay where it is. But if it is not being afforded the importance it deserves, then frankly we would look with favor on seeing that it was afforded that importance.

Chairman HUMPHRREY. When you say the importance, are you speaking about the timeliness of it?

Dr. PAARLBERG. No, the time for processing.

Chairman HUMPHREY. You mean it needs to be processed more quickly ?

Dr. PAARLBERG. Right.

chairman HUMPHREY. This is something we might want to write to the Department of Commerce about. I would suggest we at least inquire of the Department of Commerce whether or not they would be willing to give it a higher priority.

Dr. PAARLBERG. On the recommendation in the report with regard to their information on fertilizer—this is a very important question, of course, and we have tried to improve our work in this area. There is an interagency fertilizer task force recently constituted, and they are focusing more attention on the subject. We work with TVA and the FAO, and we think we have improved our work in this area.

The Statistical Policy Division of the OMB is working to bring about a better coordination in that area. We think we're making progress in that area.

My final comments are on recommendations 10, 11, and 12 of the report. These refer to ways of making basic, long-term improvements in the foreign agriculture information system, and we are in accord with all three of these recommendations.

Chairman HUMPHREY. Are you aware that in the Foreign Assistance Act we have some provisions for the International Fertilizer C'enter and in Huntsville. and the TVA area ?

Dr. PAARLBERG. I'm generally aware of that, yes.

Chairman HUMPHREY. We have made a recommendation of authorization of funds for our contribution to the International Fertilizer Center. Senator Sparkman has taken a great interest in that.

Dr. PAARLBERG. Well. we are in accord with your recommendation there regarding improving our foreign agriculture information systems as a matter of importance to both Dave Hume, who is Administrator of the Foreign Agricultural Serveice, *and* Quentin West, of the Economic Research Service, and Administrator of that agency, who has responsibilitv for much of the analysis in that area.

And there I'll stop, and perhaps you'll want to hear from these other gentlemen.

Chairman HUMPHREY. Yes; I still want, to ask all of you some questions, and maybe we should just go down the line first. How shall we proceed?

Dr. **WEST. Have has a time problem.**

Chairman HUMPHREY. Dave, would you like to go ahead ?

STATEMENT OF DAVID L. HUME, ADMINISTRATOR, FOREIGN AGRICULTURAL SERVICE, U.S. DEPARTMENT OF AGRICULTURE

Mr. HUME. Thank you very much, Mr. Chairman. I would mention also that I appreciate the opportunity to be here at the hearing before you and to make comments.

I think you do have my statement which is intended to be responsive to the many questions in the draft report itself. I would like to just go through this quickly, and point out the areas that should be brought to our attention.

Now, as you know, 3 or 4 years ago statistics in agriculture from overseas were not nearly as important as they are today. Agriculture has been more and more dependent upon agriculture exports and we are quite aware of the upgrading of intelligence gathering, and analysis, and putting that information in the form which it can be understood and the speedy diffusion of it among the people who are interested in it. This is highly important, and it will become increasingly important as we go on.

Now, before I make my brief remarks here I would like to introduce my colleagues; Mr. William Horbaly, who is Assistant Administrator for Agricultural Attaches, and he supervises that area; with him also is Mr. Philip Mackie, who is the Deputy Assistant Administrator of our Foreign Commodity Analysis; and Mr. Clark Ison, who is from the large area crop inventory experiment project and has a wide crop estimating experience, and that is the activity in which remote sensing was based.

Chairman HUMPHREY. Yes.

Mr. HUBIE. It is usually referred to as LACIE. And Mr. Ison is here to answer any questions that you should have on that.

Now, I'd like to adress myself to three areas.

About 2 years ago the Foreign Agricultural Service was reorganized and one of the principal reasons it was reorganized was to try to upgrade the intelligence and the reporting and information functions.

To understand what we did let me describe the Commodity Division within FAS as part of the reorganization. The earlier division had two responsibilities. It had a Foreign Marketing Branch, it had a Foreign Commodity Analysis Branch, and it had a Foreign Competition Branch. Marketing was the area that was somewhat competitive with the other side, so what we did was split off the marketing and put a specialized line of supervision and delegation to the marketing side, and at the same time we had left the intelligence side or the analysis side also with a specialized line, so we have upgraded specialization as far as analysis of commodities is concerned within the Foreign Agricultural Service.

This, we believe, has enabled us, and will continue to enable us to build up quality as well as quantity and timely dissemination of information in these areas.

Now, you might ask what we are trying to do. Now, Mr. Chairman, I am a layman, and I have set a rule. I have to understand what they are doing. If I can understand what they are doing, then probably evreybody else can.

Chairman HUMPHREY. I work on that basis too.

Mr. HUME. There are two major areas that we are giving emphasis to, and I would call it first the return of fundamentals. We are gathering information on a country-by-country basis, and on a commodity-by-commodity basis under a supply-utilization format. In addition, we are adding outlook and forecasting information.

Now, it seems to me that if we can determine what supply is and those things that go with it, such as production, and consumption, carryover, export, and so on, for each country, for each commodity, we will eventually be able to come forward with information which we don't, have now or which will be vastly improved and we are working in that direction.

For example, Dr. Meeker has told me this morning that in programing the computer, and they are focusing on this, almost three-quarters of a million separate pieces of information for dairy and poultry production in selected countries went into that computer to provide the 10-year history base against which the future operations will take place.

So this has all been done within the last year and a half. In addif ion, the other major approach that we are making is we are in the process of developing what we call a world trade system, and this simply will put in the computer export-import information by country source. In other words, if we ask ourselves, take Germany, Japan, or any country, what kind of commodities are they receiving, and where are they receiving them from, and in what quantities. NOW, in our opinion if you can fine tune this supply-utilization format with forecasting of production, if we can develop this world trade system, and we think we can, particularly in FAS, we will be able to give the agricultural community and others in this country information that they haven't had and that is almost the ultimate at this stage in the Foreign Agricultural Service.

I mentioned timeliness, and this is one of the problems that we have, to get information out, and to be sure that it gets into the hands of people that need it. We are conscious of the fact that we first represent farmers, and one of our missions is to get information into the hands of farmers on a timely basis and in the quantity that's needed so that they know as much about the market as some of the people in this city do, whether the-y are big or small, or in New York or here, and this is a difficult job, and we have started several *new* reports.

One is the weekly one, and this came about ***as a*** result of discussions with Senator Bellmen, in which we are putting out a press release updating pertinent foreign information.

Chairman **HUMPHREY. Yes; I recall one discussion that we had here on that.**

Mr. HUME. And this seems to be a very popular thing, Senator Humphrey, and we are picking up the multiplier effect of this information, and it has been gratifying to us.

We have established a world grain situation report which we put out frequently during the growing season, and it has been very popular. Here again, we are conscious of the fact that we need to be more timely in gathering and publishing information. This world grain report has been well received. I think Mr. Bell may have mentioned yesterday that we established within the Department two specially identified groups, one which monitors the general situation as best it can; and

another one which does the same thing in the Soviet Union. This is the kind of thing that we are doing now. There is a great challenge in the foreign field in gathering information.

I served in England for 4 years, and if there's any easy place to gather agricultural information it's in England. If I took the issuances of the Ministry of Agriculture, Food, and Forestry of that country, and if I read the Financial Times, if I read the Economist, and if I read perhaps the business section of the Times, and had a few discussions with some key information people, I knew pretty well what was going on in England.

Now, in contrast to that, I don't have to mention the People's Republic of China and the Soviet Union are completely different kinds of challenges, and if you take it country-by-country all around the world, you will run up against a much more complicated job, but nonetheless we are tackling it, and we are going to do the best we can, and we recognize that something is needed by the agricultural community, and that's something for which we have accepted the challenge, and we think we are on our way.

Thank you.

Chairman HUMPHREY. Thank you very much.

You may recall that Senator Bellmon and I worked with you to get an additional attaché in Moscow, and I have introduced a proposal in the Senate for an attaché in the People's Republic of China. I see according to your testimony that our representative there, Ambassador Bush, is working on that matter, and hopefully the Department of State is giving priority consideration to this.

By the way, I intend to talk with Dr. Kissinger about giving extra emphasis to this, because the People's Republic of China is such a large component of any agriculture information service. Either in terms of a gap, or in terms of an input, we need that information.

You mentioned we have placed one attaché in Vienna, who additionally has responsibility for Hungary and Czechoslovakia. Another attaché in Yugoslavia also has responsibility for Romania. Wouldn't it be wiser or desirable to have one per country?

Mr. HUME. Well, I'd say they were at least two things, Senator Humphrey, I think there are situations where there wouldn't be enough work in certain countries, in small countries.

Chairman HUMPHREY. Oh, yes, I recognize that. You may have to regionalize some of that.

Mr. HUME. It's simply a matter of authorized ceilings as to the number of personnel we are authorized to hire, and certain amounts of money. If we were without a ceiling, and had no problem with money, why we could do that. Incidentally, we are very much aware of your support in trying to get an agricultural officer to the People's Republic of China and we hope to name one within a month or so.

Chairman HUMPHREY. That would be great.

Mr. HUME. The State Department is coming through and also we are quite aware of the support that you gave in placing an additional man in the Soviet Union, and I think this was a constructive thing for American agriculture.

Chairman HUMPHREY. Well, Senator Bellmon and I might want to come to you and talk about whether or not these ceilings have to be adjusted, and wheher or not additional funding should be made available.

This is not, a very politically sexy subject, as you know. This is sort of the Lord's work that you're doing here, and nobody really gets excited about it,

Mr. HUME. We"re already doing a lot of thinking on that 1ine. Thank you.

Chairman HUMPHREY. David. do you have to leave urgently? If you do I have two or three additional questions that I'd like to ask you.

Mr. HUME. Not until 3 :30.

Chirman HUMPHREY. All right. We'll get Quentin in here first then. Dr. West ?

STATEMENT OF DR. QUENTIN M. WEST, ADMINISTRATOR, ECONOMIC RESEARCH SERVICE, U.S. DEPARTMENT OF AGRICULTURE

Dr. WEST. Thank you, Senator. It is a pleasure to be back, to talk with -you. The Economic Research Service is charged with supplying analytical information on the whole agricultural system. We work closely with FAS in putting together that informtion on the foreign side which impacts on not only our domestic system, but our whole foreign policy. So we have quite a wide charge As the new Administratator in 1972. I felt that we needed to take a fundamental look at our research, and how we were organizing it *to* bring ERS up to the]evel of performance we thought was needed. Two of, our divisions had existed since ERS was organized, and another one had existed since the thirties without too much change in the basic program. One problem was that our coverage of the commodities was divided into two different research divisions and one more division for the situation and outlook for the markets. So we brought in some people from the Departments, other Governrment agencies, and from t e universities, to look at what was ERS' role and how we were organized to carry it out.

Unfortunately that should have been done earlier because about the same time it began in 1972, some tremendous changes in agriculture and the economy broke upon us. The way we were set up and the flow of data that we had w-as satisfactory back in the 1920's and up through the 1960's. As you know, if you look at the chart of commodity prices and their variation, they go along fairly steady all during those decades, and suddenly in the seventies they become very volatile.

Chairnmn Humphrey. Yes.

Dr. WEST. So the way we were organized and the procedures which we used were acceptable during the earlier time period. But, they just did not serve as well when we got into the seventies when our tremendous surplus, which had insulated us from the world conditions had disappeared.

For example, we had been estimating farmers' seasonal pattern of selling their products on what they sold on the average for each month of the 3 preceding years. That was the information we had for making estimates of farm income. And for previous decades that worked quite well, because they had maintained similar patterns.

But as you know very well, the farmers don't follow the same marketing patterns that they did some years ago because prices are so much more volatile today.

Chairman Humphrey. Yes.

Dr. **West. But we** did get major changes in ERS underway early in 1973, with emphasis on refocusing of our research priorities. We also combined our outlook and situation work with the research function, and greatly strenghened this work by shifting some $600,000 and 19 people internally. We also asked Congress for some additional money, and we were given a half-million dollars to further improve . our work in outlook and short-term forecasting. So we have substantially strengthened this work.

Not only have we put more people there, but we've changed our analytical approach. We have instigated what we call a quarterly memorandum that we use each quarter to run through the whole agricultural situation, what we think is going to happen in the area of production and how that relates with exports, or what the carryover will be of commodities and how that impacts on farm prices, and therefore on the farm income, and also how it impacts on food prices. It is quite a complex system. *

In addition we look at the following crop year with what we call a contingency analysis In it we say, what happens if the weather is good, or if it's bad or what happens if economic conditions are bad, or other alternative assumptions.. We get several contingencies, and we look at them, and say what will be the impact on the food and agricultural system if these things happen.

We also meet quarterly with representatives from the Council of Economic Advisers, the Federal Reserve System, the Library of Congress, the Treasury, and OMB, to go over these analyses, We inform them of the way we see the outlook and also get their feedback on it—and how they see the impacts. A lot of this goes beyond the agricultural part of the economy.

Chairman HUMPHREY. How often do you do that, Dr. West?

Dr. West. Every quarter.

Chairman Humphrey. After you have gone though that exercise in the execuive branch of Government and the Library of Congress, would You be willing to do a similar exercise for the Joint Economic Committee!

Dr. West. We certainly would.

Chairman HUMPHREY. I think that committee has been derelict and negligent over the years on agricultural economics, which is so vital . to the economy. I'm going to make note of this. When do you do your next briefing.

Dr. West. In the middle of October.

Chairman **HUMPHREY. I'll** keep that in mind since we're trying to get a better picture of the economic developments.

Excuse me for interrupting, go ahead, sir.

Dr. WEST. Let me mention again, just for the sake of information, that we are looking very carefully **at** our whole methodology. Now I think we have not had a bad record in our forecasting. But, we ran into so many forces in 1973 which—

Chairman HUMPHREY. A combination of events, yes.

Dr. Wm. Thus, we were low in our estimates of farm prices and the food price increase. Actually though as we look at forecasting we do not expect to hit it on the nose. In fact, if forecasts are unfavorable for example, then either the farmers or the administration ought to do something about the situation through policy changes or program changes and so on, and therefore invalidate the forecasts.

But the thing we were not doing was to document what assumptions we used and to trace the course of events that canned our major assumptions and thus our forecasts to change. We have now set up a group to follow that through and to track and improve our forecasts and our methodology. This work is really moving forward.

Also as part of this effort we are trying to handle the large volumes of data more rapidly. It used to be that we only ran through this analysis once a year, but now we are doing it quarter. We intend within 6 months to be able to run through this month y so that wc do not have to wait for new quarterly analyses.

'To do that, we have centralized our data system at the agency level and we have placed a high priority on improving the data flow. We first worked on our analytical capability and set up our structure and our methodology for improving our analysis and then the second priority was put on our data flow. It really amazed me when I took over the agency that with our responsibility to provide data to the whole agricultural economic community, we had never had our own survey data to provide our kind of needs. We had always relied on others in piecemeal fashion.

Chairman HUMPHREY. Yes.

Dr. WEST. We had a couple questions on an SRS survey, we got Census to add a couple of questions, and we had a little information from the Internal Revenue and so on. So our first priority on this was to put together some resources that ERS and SRS had and request some additional resources which Congress is in the process of approving. We will start this year with an annual economic survey of farming that will give us a flow of needed information.

Also we do not want to limit this to just farming, because a real impact on this farming can come from the farm input sector such as for fertilizer use. And we need to know more about what goes on beyond farming in terms of processing, and distribution, and also in retail.

Chairman HUMPHREY. Yes.

Dr. WEST. For a long time, of course, the public and Congress have had a concern about where the consumer dollar is going, and how much of it is going to the farmer. We have programs to estimate this that have existed for a long time, but we need a lot more information on just what happens on the structure and the costs in the input industries and in the processing and distribution industries. So we asked for some additional resources this year and this request has been approved by both Houses of Congress. We expect to get underway in this new program very soon. These are the principal places we started on our flow-of-data needs.

To put out this information on a more timely basis we reviewed our whole flow of outlook and situation reports. There are many of these, the wheat situation, the livestock and meat situation, and so on.

Chairman HUMPHREY. Oh, Yes.

Dr. WEST. As a result we have started publishing the Agricnltural Ontlook. This is a monthly publication in which we try to synthesize all the information, and try to bring it up to date each month.

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Chairman HUMPHREY. Does every Member of Congress get one of these ?

Dr. WEST. Yes.

Dr. PAARLBERG. I am sure we have provided them to the House and Senate Agriculture Committees.

Chairman HUMPHREY. I want to make sure that they do.

Dr. WEST. We had quite a nice letter from Mark Andrews on this new monthly publication.

Chairman HUMPHREY. I talked to Mark on the plane going back to Minnesta and North Dakota about this. I've heard it's an excellent publication that summarizes the most important information of the month.

Dr. WEST. That's right. After our next quarter] in-house analysis, we will summarize it in the Agricultural Outlook. We have not released to the public previously this analysis. It has been internal. The "Agricultural Outlook" will include the essence of our quarterly review. And as I say. hopefully within 6 months we will be in a situation where we can run this analysis through once a month. So each month we can update our evaluation of the production, the supply, and the exports, and the impact on the prices, on income, and so on.

Chairman HUMPHREY. I suggest most respectfully that you send a copy of this to every Member of Congress.

Dr. West. Very well.

Chairman HUMPHREY. It's only 535 copies, and I think it would do a lot of good.

Dr. WEST. Right.

Chairman HUMPHREY. Around here you have to be sort of a general practitioner with the appetite of a centipede to be able to live.

Dr. WEST. Well, another publication is 'agriculture Supply and Demand Estimates:" which is put out monthly, following the crop reports that come out, from SRS. We run through an analysis in cooperation with analysts from ASCS, FAS, and others on the Interagency Commodity Committees. We sit down and run through this analysis of what they. see in the new crop report, what this means in terms of production, and what adjustment might be made in exports and carryover. and so on. This has been, I think, a very valuable Instrument.

Chairman HUMPHREY. Sort of an analysis of the crop report, and what its meaning is in reference to the total supply situation?

Dr. WEST. Yes. We do this right after the crop production and grain stocks reports come out, and planting intentions reports. It's really a quantification of all the different things.

Chairman HUMPHREY. Oh, yes. it has beginning stocks, That's the kind of thing that Dave was talking about. Does anyone from the newspapers ever get these?

Dr. WEST. Oh, yes. There are lots of them.

Chairmnn Humphrey. Well. why don't they use some of that ?

Dr. PAARLRERG. Well, they do increasingly now.

Chairman HUMPHREY. Are they using more of it ?

Dr. PAARLBERG. Yes.

Chairman HUMPHREY. There is so much misinformation when I go home to our great agricultural State, and for example, speak to the chamber of commerce of a town. They have been reading, and listening to radio and TV, and it seems the local paper gets so much misinformation. Maybe it is because they don't understand it. This is a complex matter.

Dr. West. We also put together in name form all of the information that flows to us weekly. I think that comes up to you. If not we could provide that to you.

Dave is doing something similar on the foreign side, and we try to combine some of that, with what's happening on the domestic side. This weekly - highlights memo includes reports that come out during tile week that relate to the outlook situation, even the weather for example.

Chairman HUMPHrey. Yes.

Dr. WEST. As we look ahead, some of our questions right now are to review our data series. Don mention@ that we have had this group in, including people from the universities, and the American Agriculture Economic Association to kind of coordinate this review with us.

Jim Hildreth was chairman of one group, and he had someone from Commerce who looked at our farm income statistics and came up with some recommendations on how we might improve not only the data that we use to do this, but also some of our concepts. This is important because some of these concepts are reaching back to the small farms, which are much different from the typical farm situations. This is a copy of that task force report.

Chairman HUMPHREY. Thank you.

Dr. West. We have one currently underway under the leadership of George Brandow looking at the farm retail price spread data.

Chairman HUMPHREY. Yes; we've had George doing a study for us in the Joint Economic Committee as well.

Dr. PAARlBERG. Yes.

Chairman HUMPHREY. We are are to publish that study when it is completed. That doesn't interfere with anything he's doing for you?

Dr. PAARLBERG. No.

Chairman HUMPHREY. No ?

Dr. WEST. In fact, we think we will do this type of review at least once a year, and take a look at some of these areas to make sure that they are relevant for the present situation in agriculture.

We need to pursue our data and needs in our long-term plans. We need to look at the consumer, for example, through a consumer panel to get the data and information on What happens in what people buy, and as this is reflected by prices and by income, or different goups, and so on. Also On how consumers shift from one commodity to another as price changes. because we need to update some of our demand estimates and what causes shifts in demands.

In the long term we are looking for an improved data base for all of our research programs and we feel a need to put proper emphasis on this. For example. I already mentioned the structnre and performance of input industries and food processing and distribution. We have money for starting a first step in this. and if that's successful we'd like to move on to get more data in this area.

Also we need to get some more data on land use, land and water use, and changes in the cost of improving our lands so that we can get a better estimate of what our capacity is to produce for future demands.

I mention other things in my statement, but I think these are most important.

Chairman Humphrey. We will include your complete prepared statement in the record.

I hava few general questions, end David, since" you're going to have to get away. I'll ask you first.

Why are world agriculture production and estimates not subjected to broad review similar the crop reporting board review in the Statistical Reporting Service, and the Outlook Situation Board in the Economic Research Service?

Why don't you give the world agriculture production and trade estimates the same kind of review?

Mr. HUME. Well, they do get a broad review. It's not a situation outlook board.

Chairman HUMPHREY. Do you participate in that ?

Dr. West. Yes.

Mr. Hume And there is an interagency group that does review these. " I don't think there would be any objection to what we have. I think it raised some questions as to time, an the situation rewiew takes a little time, and once in a while we feel that we 'are—accomplishing the same thing under our system as it exists, but it does take time to improve that.

Chairman HUMPHREY. We've had some suggestions to create a World Crop Reporting Board within USDA that would review all sources of country production information—attaché reports, foreign release statistics, weather yield analysis, other data, from all departments of the Government on a timely basis. This Board would produce a forecast or estimate that would be acknowledged within the Government; that is, with all our department USDA, State, et cetera, as the best number. Thus we would eliminate duplicate numbers floating within the Government.

What's your view on that?

Mr. HUME. Well, I will give you my view, and then I will ask Dr. Paarlberg to comment on that. But my view is that this would inevitably slow up the providing of this information. If I understand what you am talking about, it would bean interagency or an interdepartmental type of board.

Chairman HUMPHREY. Right.

Mr. Hume. And you would raise a committee and I'm sure that there would be differences of views, there would be headaches with language, and they would be arguing over semantics, and tins is a very big order to take in the whole world.

I would think that-maybe-I would just say that there would be too much bureaucracy in that to make it practical. I can see the idea. and I would support the idea if it could be organized and operated with the assurance that it would do so on a timely basis. I wouldn't object to the idea, but I don't see the operation being practical.

Chairman HUMPHREY. You feel the factor of delay here is vital and important here?

Mr. HUME. Well, to put it bluntly, Senator, I think I would compare this with trying to get a State Department clearance to clear some of our agricultural cables. We sometimes take a month to do that, and only a few words are involved. Now, if I understand it correctly, this kind of clearance would be much more complex than even that. So I would have to ask first, what are you going to get out of this kind of an operation that you don't have now.

Chairman HUMPHREY. The only thing you'd get out of it is an agreement upon the statistics and figures and analysis of projections.

Mr, HUME. Maybe we could publish it and let this take place in retrospect. They either confirm it or they correct it.

Chairman HUMPHREY. I tell you what I'd like to do. I just wanted to raise these questions because no one knows more about these things than you men.

Mr. Hume. We appreciate that.

Chairman HUMPHREY. You might want to take a look at that.

Mr. HUME. All right.

Chairman HUMRHREy-. Our aim is to get an idea of the 'big picture in a timely fashion.

Dr. WEST. Could I respond to that ? We do this on an informal basis. I am sure that CIA doesn't come out with a review, and we do discuss this, but there is no attempt to force the position.

Chairman Humphrey. To formalize it ?

Dr. WEST. Well, to reconcile the figures. For example, we have not been in agreement! all this year on U.S.S.R. and for a long time they held out for a much higher level. For U.S.S.R. grain production this year they were holding at 210 million metric tons and we had the estimate clown to 180, and they suddenly dropped to-well, first 165 and then 170. and they arc still at 170 while we're at 175. So the point you made is important. For this whole season we have not seen eye to eye on just how we've interpreted conditions in the U. S. S. R., but we do know what each other is doing.

Chairman HUMPHREY. I understand that. I'm not suggesting this all be clone by one agency. It's just like the intelligence services of the Government.

Dr. WEST. Right.

Chairman HUMPHREy. I don't like to have all of it concentrated in one hand. I think it's important to get different people looking at the same. situation. They have different perceptions and estimates.

Dr. West. See, we feel that in agriculture with our extensive attaché system, we have people out there who know the countries, and thus we have the best system in agriculture.

Chairman HUMPHREY. Right.

Dr. West. Now to set up something, for example, that would have to be approved by the State Department and approved by CIA, before we could get any information would get us into a very difficult situation.

Chairnmn Humphrey. I'm afraid you're right.

Dr. PAARLRERG. If we had to all agree it would be less efficient.

Chairman Humphrey. I see.

Dr. WEST. If we could analyze the reasons why there is a little different interpretation on the situation, it might be more clear to people like YOU as to why, for example, CIA held at 210 for sometime, and then dropped down to 170. or why we are still differing. of course, we aren't estimating that close anyway, but-

Chairman Humphrey. Yes; that was a considerable variance

Dr. WEST. That was a variance which has impacted on our policy.

Chairman Humphrey. Indeed. The CIA indicates that major communication barriers within USDA have been somewhat overcome since 1973, but some barriers they say remain-namely economic and food intelligence information. This only reaches top level USDA decisionmakers. The information that passes to the working level is well filtered. Not all senior analysts in the Economic Research Service are cleared to receive it, is that correct?

Dr. WEST. Well, on the foreign side, all of them are cleared to receive it. Not all of them on the domestic side are.

Chairman Humphrey. Likewise, what flows to Congress undergoes more interpretation from USDA. There are two lines that we might pursue here. one is to explore with USDA, the accuracy of CIA reports regarding the kind of information received from the CIA, the frequency, the quality, the flow; and second, explore how the Congress can obtain access to this intelligence data on a regular basis.

What we're really talking about here is the fact that the CIA is obtaining worldwide information through various means, which may or may not be as accurate as the Foreign Agricultural Service attache system. I think the use of electronics has limitations in providing this information.

Dr. WEST. Our relationship with CIA is quite close, and in normal analyses we have no problem in talking to their people and getting information. There have been certain times when there has been sort of a clamp put on things. The working relationship is very good at several levels. It's only sometimes when they learn things only at the top level and they come out saving this is sensitive.

Chairman HUMPHREY. What concerns us is not only assuring that the government has the most accurate information as possible, but timely market information. This means so much to our farm producers, since our farm people today are capable of holding the crop for a period of time in order to wait for better marketing conditions.

I'm essentially concerned about the producer in this area. I talk to many of our young farmers out home and they are well educated and really want accurate and timely data. The-y are not interested in reading last week's St. Paul Pioneer Press, I predict that within 10 years we will have computer printout services providing this information to many farm homes.

Dr. WEST. This is one thing that I had in my statement that I didn't mention. We have set up an arrangement with the extension service that provides our current information as soon as it's released. We put it on the computer and the outlook extension people can take that off immediately by tapping into the computer. So they don't have to wait for the mail service to get it.

Chairman HUMPHREY. Great.

Dr. WEST. And as you say, I think a lot of farmers will move in tlmt area, and there's no reason why they couldn't tap into this very same information.

Chairman Humphrey. It's vital to the credit system too. The banks make loans on projections as well as on reality. Don, you and I should turn the clock back about 20 years and we'd have a great time.

Dr. PAARLBERG. I think we've got that much time left.

Cairman HUMPHREY. I think we have too. We could get these kids all shaped up.

Dr. PAARLBERG. Right.

Dr. WEST. With the kind of price fluctuations we've been getting, a person if he sells right, can make as much as a year's crop, if he just sells at the right time.

Chairman HUMPHREY. David, I'll send you any other questions.

Mr. HUME. May I express my appreciation for your time.

Chairman HUMPHREY. It's good to have you here.

Mr. HUME. It's nice to be here. Thank you.

Chairman HUMPHREY. Dr. West. I'd like to ask you a few questions. How is the responsibility for estimates of export demand divided between ERS and FAS commodity analysts

Dr. WEST. We work with them and they have the final responsibility. We have an interagency commodity committee and we provide a lot of information and analysis, and we discuss this, but they have the final authority.

Dr. PAARLBERG. We take their inputs and perhaps have some influence or carry some weight.

Dr. WEST. We do, there's no quest ion about that.

Chairman HUMPHREY. Do you have any plans for issuing monthly digests of world agriculture for general distribution?

Dr. WEST. We have a regular section on world agriculture in agricultural outlook, But also this past year we have moved from putting out the more comprehensive world agriculture situations once a year to three times a year.

Chairman HUMPHREY. That is very, very helpful.

Dr. WEST. Also four times a year we're putting out in conjunction with FAS an outlook for U.S. agricultural exports.

Chairman HUMPHREY. Do FAS and ERS worth together on this world agricultural outlook ?

Dr. WEST. We work very closely with them, but we do have the responsibility for, the world agricultural outlook.

Chairman HUMPHREY. You have prime responsibility ?

Dr. WEST. Right; on this outlook for U.S. agricultural exports, we work in conjunction with them,

Chairman HUMPHREY. Is it correct that only the fibers and tobacco analysts have clearance to receive classified information?

Dr. WEST. That could be true, for our domestic. analysts but I am not sure on that.

Chairman HUMPHREY. I think 1 know why, but go ahead.

Dr. WEST. In our foreign area. we just haven't had enough resources to cover all the commodities.

Chairman HUMPHREY. And my friends from the South have very powerful positions on the, Committee on Agriculture and they do see that cotton and tobacco are taken care of.

Dr. WEST. Our domestic commodity analysts do more of the analysis on tobacco and on cotton across the board including the foreign areas, so there's more reason for them to have a clearance. We have quite a group on the grains and the livestock products in our foreign demand and competition division. so there is less need for our domestic analysts in the commodity economics division to be cleared. However, I am quite sure that the program leader, Jim Naive, is cleared. Do you know. Mr. Gasser ?

Mr. GASSER. I think that's right.

Chairman HUMPHREY. I think you should find out why there aren't-clearances at more levels. There's no reason for this.

Mr. GASSER. From the foreign division we do have all Our analysts who are cleared for at least confidential and all the program leaders are, cleared for secret and higher.

Chairman HUMPHREY. That's in the foreign area?

Mr. GASSER. That's right, in the foreign demand and commodity division.

Dr. WEST. This now runs up to about $1,000 to clear someone for secret. If they don't need that clearance then that's money you save.

Chairman HUMPHREY. I agree. But I think the question for you, Dr. West, is to determine if more people could benefit by having this clearance.

Dr. WEST. We'd be very glad to have more of them cleared,

Chairman HUMPHREY. I want to emphasize that you know whether or not your work is in any way limited by this restriction..

Dr. WEST. It has not come to my attention that there is any problem in lack of clearances, because we do have the authority to clear who we want to.

Chairman HUMPHREY. OK.

Dr. WEST. So that has not been an issue that's been bought to my attention.

Chairman HUMPHREY. This is just another question that has been brought up in discussions by the OTA Food Advisory Committee which is headed by Dr. Wharton of Michigan State..

How are the reports of the Interagency Commodity Estimates Committee integrated with the ERS agricultural supply and demand instruments ?

Dr. WEST. They are one and the same thing.

Chairman HUMPHREY. They are?

Dr. WEST. This publication called 'agricultural Supply and Demand Estimates" is really the result of the interagency commodities committees. It goes through the Outlook and Situation Board which is in ERS. SO we do most of the analytical work, but these committees are chaired by representatives from ASCS.

Dr. PAARLBERG. I have overall responsibility, Senator Humphrey. I chair the entire operation. Each one of the commodities has its own chairman, and they report to me, so this is cleared through me, both the supply and demand estimates that are published here, and the interagency group that makes projections regarding yield and so on for the various crops.

Chairman Humphrey. Would it be feasible or desirable to organize a food and agricultural intelligence unit made up of key commodity specialists from ERS, FAS. and ASCS ?

Dr. WEST. Well, we have that in each of the commodities, but not for food, per se.

Chairman HUMPHREY. The point would be to unify it into one panel.

Dr. PAARLBERG. Really they are here. There's a committee for each one of the major commodities, and they are integrated under my overall chairmanship and each one of these groups does, in effect, contain the experts on these commodities from ERS, FAS, ASCS, and AMS. when that's needful.

Chairman HUMPHREY. So you in a sense have a working unit?

Dr. WEST. We really have that.

Chairman HUMPHREY. Very good.

This has been a good review. Dr. Paarlberg. we would be happy to have any suggestions you would like to contribute to this report. By the way, I haven't mentioned today what you're doing to buttress the FAO. We heard yesterday that the FAO is doing a better job, for example, on some of its projections, and on gathering agricultural information at the international level, Are you of that opinion?

Dr. PAARLBERG. We are. They are improving in their work and they work cooperatively with us. They can do some 'things that we can't do. and we can do some things that they cannot.

Dr. WEST. Could I mention a speific example ?

Chairman HUMPHREY. Yes.

Dr. WEST. We used to do food balances by country, for which we
9 tried to get all the information on the crops that are produced, put together the total Consumption, and come Up with a number of calories per capita. We did this in the middle 1960's as a basis for what we called the world food budget.

Chairman HUMPHREY Yes. I remember that.

Dr. WEST. This was a most comprehensive analysis of the level of consumption around the world. Now, we had not used FAO too closely up to that time, because they were pretty much restricted by what the Government said they could do. But as a result of the indicative world plan, that whole exercise, they set up a much better system of statistics in which they kind of filled in the gaps. Some of their information came from us. We had a struggle to put this out on the African countries, and then a few years later FAO crone out with some food balances for Africa, and I thought we could thus update ours. our food balance on Africa, and we looked at them and they were the food balances we had prepared earlier. They got theirs from us.

But anyway, they are putting out on a regular basis these food balances. and we felt that it would be best to put our resources on those things that are most critical in our whole export program. Rather than trying to periodically dig in to solve the many problems of other commodities that go into making up these food balances, we would let FAO do it.

Chairman HUMPHREY. Right.

Dr. WEST. So we are not now doing these comprehensive food balances.

Chairman HUMPHREY. Instead you rely on FAO ?

Dr. WEST. That's right, because I think theirs now is as good as we could do, and I might say, that's not too good, because you don't know how many bananas there are produced, -so all this has to be pretty much of an estimate. Unless we get a real breakthrough on some of these minor crops, you will still be estimating at the same levels, or increasing it by population growth. or something like that. This is the best you can do, and so we thought it was better to concentrate on other commodities. Grains, of course, make up a big part of the diet of most people in the world. Grains are important in the trade and I think they are the best indication of what's happening in world food consumption.

The last time we did Asia. for example, we ran through all this exercise, and we came out with some results that we couldn't believe. After looking at it and discussing it we decided, to estimate for India here, and put all the countries in this relative order. and go back and adjust it to come up with these estimates. Because India was the best information we had. Information on minor crops was not that good, so we concentrated on the groins.

Chairman HUMPHREY. Thank you very much, gentlemen.

Dr. PAARLBERG. Thank you. We appreciate coming up here, and we think this is a constructive report, and it gives a fresh look from the outside of our operations, and it provides the occasion for us to review this whole matter with you, which we are happy to do.

Chairman HUMPHREY. Thank you very, very much.

[The prepared statements of Dr. Paarlberg, Mr. Hume, and Dr. West follow:]

STATEMENT OF DR. DON PAARLBERG, DIRECTOR OF AGRICULTURAL ECONOMICS, U.S. DEPARTMENT OF AGRICULTURE

I believe that we in food and agriculture have one of the best information systems of any sector in our economy. And we have, without a doubt, the best food and agriculture information system in the world.

You have asked the administrators of USDA agencies dealing in world agricultural information to also appear at these hearings. I don't intend to duplicate their comments but I would like to make a few brief remarks in response to major recommendations in the report, "Food, Agriculture and Nutrition Information Systems: Assessment and Recommendations" made for the Office of Technology Assessment.

I believe the report is quite comprehensive and serves the very useful purpose to highlight concerns about inadequate information. Evaluation and assessment reports are always needed, especially when they also contain recommendations on what to do.

The first two recommendations address the question of how to obtain more analytical capability for Congress. We support the idea that Congress needs more help in dealing with the large information flow on food and agriculture. And we support both recommendations as reasonable ways to provide the increased capability.

More analytical capability on the staffs of the agriculture committees and in the Congressional Research Service should help to make the current information system more useful to the specific needs of Congress. In addition, we stand ready in the Department to be as responsive to analysis of information for Congress as our resources will allow. Recent examples of our response to these needs are testimony on various issues by top staff people plus reports on fertilizer, energy, transportation, and the structure of the food and fiber sector.

At the same time the effectiveness of additional analytical staff in the Legislative Branch or of our staff to address specific issues is dependent on our doing well in our basic mission. That is to develop and maintain a capital fund of knowledge on which economic intelligence for program and explicit policy analysis can draw at any time.

There are also a large number of very capable analysts in the land grant university system. I'm sure that Congress could benefit from increased liaison with these people and I believe you would find them to be very responsive to your needs.

A second major topic in the OTA report addressed the problem of obsolete data series. This is a pertinent problem, primarily caused by changing structure and changing flow of economic activity in our food and agriculture system. However, the solution lies not with more general statistical review committees but with action by the agencies having responsibility for our food and agriculture information system.

'The Department has a statistical review committee made up of members of the American Agricultural Economics Association (AAEA) and the American Statistical Association (ASA). Top staff people in ERS and SRS are members of the economic statistics committee of AAEA and have association with many other important users of agriculture information through membership on the *Census* Bureau's advisory committee on agriculture statistics. These are useful activities but not major agents for change.

We think the solutions to these problems are going to be very difficult at best. Thus the managers of the key agencies. those who know the data problems and the difficulties of change most thoroughly, and who must carry through on commitments for change. are in the best position to modernize, coordinate, and standardize the food and fiber data series.

In addition to the normal program evaluation process. our staff has been involved in a number of special activities toward this purpose. We worked a long time with the Census Bureau to develop what we thought would be a more appropriate definition and classification system for describing today's agricultural producers. Other discussions with census staff will lead to improved information on corporations and partnerships involved in farm production, on identification of other major economic activity of large corporations involved in farming, and on the use of contracts and agreements in production and marketing.

Another approach we have taken to this problem has been to select a specific data series and have an ad hoc task force evaluate the series and recommend improvements. We had such a task force of university, foundation, and government personnel look at the farm income estimates series last fall. Currently we have university, industry, and government people on a task force studying the farm-retail price spreads, market basket, and market bill data series. We believe this ad hoc approach has been very useful.

The third major topic of discussion in the OTA report concerns the timeliness and reliability of data, especially as it relates to the Census Bureau. The question of needed changes in the Agricultural Census including possible transfer of the operation to SRS is a complex issue without an immediately clear answer.

What is clear is that the Agriculture Census program *needs* to be modernized to use current data gathering techniques, to more nearly meet the data needs in today's more specialized agriculture, and to develop ways to produce the results in a more timely fashion. It is also clear that much closer coordination between Census and SRS needs to take place and if the activities remain in two separate Federal Departments, there should be a greater provision for efficiencies of planning and operation.

The Census of Agriculture has a long history of providing useful data on the farming industry. At one time, the census figures were used by the Department to benchmark and revise our crop and livestock estimates. However, implementation of improved modern probability survey methods in SRS has resulted in crop and livestock statistics that surpass the quality of Census data. In fact, the Census Bureau has used SRS statistics in its 1969 and 1974 programs to measure incompleteness in the Census data.

The Census of Agriculture provides needed county data and other information beyond that produced by the Department of Agriculture. This includes detail on structure and organization of the sector that is becoming increasingly important. But we don't feel that a complete census of farms is the most cost-effective way to conduct the program, nor is continuing to get all the data once every five years the way to get the figures published in a timely manner. We believe that the Census should be replaced by sample surveys and that much of the Census data would be better obtained annually over a five year period with emphasis once each five years on generating county estimates.

The Department is prepared to enter into full collaboration and joint study of this issue with the Census Bureau.

I have only a *brief* response to the issue of a more fully coordinated fertilizer information system. We are participating in an Interagency Fertilizer Task Force that was established by the President's Economic Policy Board. This has been a useful activity and a forum for discussing problems in information on fertilizer. Our analysts have given quite a lot of thought to what gaps there are in this information system. They have had discussions with TVA, FAO and others and laid out plans to improve the information. This includes more detailed data on fertilizer inventories consumption and prices, data on the structure, costs and practices of the fertilizer industry to help in analysis of fertilizer supplies.

Beyond this, we look to the Statistical Policy Division in OMB as having the authority to bring about closer coordination in information that is scattered across several agencies of Government.

My final comments are on recommendations ten, eleven, and twelve in the OTA report. These refer to ways to make basic, long term improvement in foreign agricultural information system% We support all three of these recommendations since improvement in foreign statistics is so vitally important.

We believe that the Department's role in AID funded technical assistance programs has been very productive. This type of direct assistance is probably the best way to improve statistics in countries eligible for AID funds. AlD, FAO, tile Ford Foundation and the Rockefeller Foundation, among others, have also had an active and useful program of financing short-term training for foreign agriculture statisticians in the United States.

Thank you Mr. Chairman. I'll respond to any questions you may have.

STATEMENT OF DAVID L. HUME ADMINISTRATOR, Foreign AGRICULTURAL SERVICE, U.S. DEPARTMENT OF AGRICULTURE

Mr. Chairman, I should like to begin by posing three propositions:

Sound Intelligence and competent analysis are increasingly important to a world agriculture being called upon to' feed more people better.

The reporting and analysis system carried on by the Foreign Agricultural Service-covering more than 130 countries and more than 200 commodities the world's best recognized and most used.

We have strengthened that system substantially in the past three years—and have work in progress to strengthen it further.

The Foreign Agricultural Service consists of 850 people, including 125 stationed overseas. It includes the Agricultural Attaches at American Embassies and Consulates in 63 foreign posts. FAS functions include food aid (PL 480), market development, international trade policy and negotiations, the (CCC Export Credit program, intelligence gathering, and export reporting. Commodity analysis is basic to all these operations.

The task of FAS commodity analysis is the collection, analysis and dissemination of agricultural commodity situation and outlook information relating to our foreign market and competitor countries. The emphasis is relating to our foreign market and competitor countries. The emphasis is on historical data series, analysis of the current commodity situation and short-term forecasts. The "model" in which we handle this information is 'the concept of supply-utilization balance. That is, beginning stocks plus production plus imports equal total supplies less consumption and exports equals ending stocks. This is the framework within which we approach all our commodity work albeit with some modifications to fit individual situations.

There are many users of FAS information-each with somewhat different needs. As we plan our work, we are constantly aware of these various users and their changing requirements. Their interest in FAS information continues to expand and intensify. They are progressively more demanding in their requests for information. Essentially, we can group these users into four types:

1. The general public; that is, farmers, the private trade, consumers and researchers.
2. U.S. Government agencies; that is, the administration policy and program decision makers, the Congress, and analysts of the overall domestic and international economic situation.
3. International or animations and foreign governments. FAS, along with the Food and Agriculture Organization (FAO), is recognized as a primary source of world agricultural data. Pick up any foreign publication which includes data on world agriculture and chances are this data will have come originally from FAS or FAO.
4. Internal FAS action offices; that is, Market Development, Trade Policy, P.L. 480 and CCC Credit. Here, the support work for the multilateral trade negotiations has placed a substantial burden on the Commodity Analysis area, and we expect this load to continue for the foreseeable future.

The product of FAS reporting and analysis is published in a number of forms to meet the needs of different users. The traditional "bread and butter" outlets are still basic to our operation-Foreign Agriculture Circulars, Foreign Agriculture Repents, the monthly World Agricultural Production and Trade, and the weekly Foreign Agriculture magazine.

In FY 1975, we published 117 FA circulars and distributed them on 25 specialized commodity mailing lists open to anyone free upon request. Foreign Agriculture magazine carried 68 major articles originating in the FCA area and nearly 1,000 short items during the year. This magazine has a circulation approaching 10,000 and receives wide secondary circulation as source material for trade publications and the mass media.

Information generated by FAS analysis is also published by other USDA agencies, including the Economic Research Service, the Extension Service, the Agricultural Marketing Service, and the Agricultural Stabilization and Conservation Service. A primary outlet is the Outlook and Situation series of ERS, We also contribute, primarily in a review nature, to the publications of the Foreign Regional Analysis Division of that agency.

In addition--in order to get wider distribution of current information on a more timely basis-FAS has undertaken a number of new services:

The export sales Report issued weekly by FAS, summarizing reports received from exporters. This Report carries considerably more analysis and interpretation than was the case when publication was first begun by the Statistical Reporting Service.

The World Grain Situation issued at intervals of one or two months—an FAS publication that is unique in the world and which is greeted with intense interest by press, trade, and agricultural organizations."

Increased use of field information outlets of the Extension Service, and the Agricultural 'Stabilization and Conservation Service, and the centralized press and broadcast facilities of the Department, including a regular weekly roundup in the Agri-Tape service to about 600 radio stations.

A new weekly summary of developments in foreign agriculture and trade initiated last June in order to provide more timely information to farmers. This is issued as a Department press release and given wide distribution.

FAS information is reprinted and reported worldwide in the general, business, and trade press-with and without attribution. It becomes part of analysis and interpretation developed by research staffs in industry, other government agencies, and international organizations. It is built into the planning of farmers processors, exporters, importers, railroads and shipping companies.

Our goal in the coming year is to review FAS publications with the objective of elimiminating duplication and at the same time providing more timeliness of information and improved analytical input. In conjunction with the FAS management, the Commodity Analysis area has reviewed publications of the Tobacco Division and is currently reviewing those in the area of Oilseeds and Products. The review in these two areas has the objective of determining end-user use and acceptability, and the ideas generated will be incorporated in our general review of FAS publications.

In addition to published information, FAS analysis provide major support to internal USDA and FAS operations. This work includes briefing and studies; spot reports on developing commodity problems; support of the CCC and P.L. 480 areas in determination of commodity availability, usual marketing requirements and prices; support of requests which come directly from our attache offices overseas; support to the Market Development area in preparing an analysis of day-to-day commodity trade problems which come up with our trading partners, and in support of the multilateral trade negotiations. In the area of MTN support, the commodity divisions have been involved in preparing offer and request lists, including item-by-item, country-by-country analysis of trade restrictions. They also provide the administrative support and analytical backup for the Technical Advisory Committees pursuant to the Trade Act of 1974.

The backbone of FAS information collection is the system of Agricultural Attaches stationed in 63 overseas posts and reporting on 82 countries. In the past 3 years, we have undertaken a substantial strengthening of their organization. We have enlarged the professional Attache staff in Moscow and in other posts where political and economic change is altering the nature of world agricultural trade. We placed one Attache in Vienna with responsibility also for Hungary and Czechoslovakia, although we had to reduce our staff in The Hague. We also have expanded the Attache's work in Yugoslavia to include Romania. We have endeavored to place an agricultural officer in the U.S. Liaison Office in Peking, and are hopeful of positive results, Ambassador Bush and the Department of State have expressed interest in having an agricultural representative assigned to the team in Peking. We are now discussing with the Department of State the conditions under which such an officer could effectively represent U.S. agriculture in the People's Republic of China. We have also requested assignment of an Agricultural Attache to our Embassy in Cairo. We have also expanded and strengthened the reporting by Agricultural Attaches already assigned.

Most attache posts are *covered by a* scheduled reporting program for the attaches on a commodity-by-commodity basis, The number of these scheduled reports has increased dramatically in the past two years from about 1,400 in early 1973 to *over* 1,900, currently. The number, frequency and intensity of the individual commodity reports vary by country depending on the importance of the commodity and the particular country involved in terms of its world importance in production and trade. Our emphasis in the past two years has been to revise these reports along the lines of the supply-utilization format, and to increase the emphasis on the current situation and the outlook for the coming season.

As an example. we receive regularly scheduled reports on the grain and livestock situations from major countries on a quarterly basis, but regularly scheduled, detailed reports from minor countries are due only on an annual basis. In addition to the detailed commodity reports we also receive numerous special reports on a frequent basis-for example, weekly grain prices in Rotterdam and weekly livestock prices in Tokyo.

Besides the scheduled reporting system, attaches are constantly alert to developing commodity problems in their areas, and they submit cabled reports on these situations. Our cable communication system facilitates constant interaction between Washington analysts and attaches in the field with respect to specific commodity problems and special requests.

This year we will be undertaking a detailed review of the attache reporting system with the objective of consolidating and refining it to tie information more closely to the needs of information users and to our analytical system. .

information from the attaches is supplemented in Washington from other sources. For example, attache reports provide leading indicators of foreign trade for major commodities and countries but detailed and complete statistics are compiled primarily from government publications of foreign countries. These are submitted directly to Washington, thereby saving the time of the attaches, while still enabling us to provide the detailed information which is so important to many of our users.

We also cooperate and share information with international organizations such as FAO, the Organization for Economic Cooperation and Development (OECD), and the International Wheat Council and other U.S. agencies such as the Census Bureau, which collects detailed data on U.S. trade; ERS, which analyzes the domestic agricultural situation and international questions of a longer-term nature; and the State Department, which provides general economic information on foreign countries.

There is an exchange of Information and views between FAS and economic analysts in the Central Intelligence Agency. The Agency's Office of Economic Research Service provides us with certain classified documents-specifically the weekly economie intelligence report, the petroleum report, and other special reports. Analysts in our commodity division-for example, those having responsibility for data from the USSR—have informal contacts with their counterparts in the CIA. These are not regular contacts, but intermittent and personal. They are nevertheless helpful to both agencies.

Another major source of FAS data is the private trade, Our commodity analysts review a large number of domestic and foreign trade publications. Personal contact with farm groups and business people is also very useful,

In addition to a constant refinement and strengthening of these techniques and services, we have assumed major new functions:

We have within FAS the Secretariat responsible for leadership in the U. S.-USSR Agreement on Agricultural Cooperation, signed in June 1973. This work will involve the exchange of about 25 economic and technical teams between the two countries during this calendar year. It is work that requires patience and endurance, but it has the promise of substantial mutual benefits as time goes on. A more detailed treatment of this effort is presented by Assistant Secretary Bell.

FAS has within the past year taken on the export sales reporting responsibility required by Section 812 of the Agricultural Act of 1970 as added by the Agriculture and Consumer Protection Act of 1973. For a time last fall and winter, we also carried on a system for the voluntary prior approval of large export sales of grains and soybeans. The export sales reporting system is providing the basic information for decisions now being made with respect to grain sales to the USSR.

FAS is also the lead USDA agency in the new experimental program aimed at assessing crop conditions by remote sensing afforded by the operation of satellites and analyzed with the aid of computers. This program is known as the Large Area Crop Inventory Experiment (LACIE).

This is an operational test of an information system which could significantly improve the continuity and content of international crop forecasts, using satellite data, meteorological and climatological data and historical trend data. Previous studies established the potential of using computer processing techniques of remotely-sensed data provided by satellites to classify crops, thus distinguishing among various crops grown in the same area. The LACIE project is a follow-up of these studies, which will aid in determining the utility and cost effectiveness of using satellite and surface derived data to monitor wheat production over large areas.

The experiment will combine crop acreage measurements obtained from LANDSAT data with meteorological information from the National Oceanic and Atmospheric Administration satellites and ground stations, and will relate weather conditions to yield assessment and ultimately to production estimates. The utility of the information produced will be evaluated on the basis of its objectivity, timeliness and accuracy, and its expected value for policy and program decision making. We are presently 6 months into the 3 1/2 year experimental program.

Such a system could provide a new capability for the United States and other countries in making agricultural production and marketing decisions; to inform us of the spread of crop diseases and insect infestations which could affect world food supplies; flash an early alert if crop shortfalls are expected from adverse weather; and provide improved production estimates to international organizations.

Whatever the sources of FAS data, raw information becomes useful only when it is put together in a form that makes sense and that is easily understood. That is our objective. Putting information together in this way requires both economic training and commodity knowledge on the part of the analyst. In the past two years we have brought into the Commodity Analysis area 24 well-trained, mainly young (in their 20's) economists. These numbers do not, of course, represent a net gain. There is an offset through retirement and rotation out of the Commodity Analysis area. We have lost something in experience, but the people we are hiring are well-trained in economic techniques and the use of computers.

We have instituted a program to rotate our junior professionals through at least two different areas of the agency in Washington before sending them to the field. We feel that this program will provide better training for junior attaches. And if all of the young people whom we send to the field have had experience in Washington's Commodity Analysis divisions, the commodity information furnished from the field should he improved.

Most of our analytical work is currently based on simple trend models, experience and commodity knowledge, and common sense. We think this has given us a pretty good track record and with the re-emphasis on reporting, etc., we have shown improvement over the past two years. This is not to say, however, that we have achieved perfection. We have been criticized at times for shortcomings in providing timely data and for a lace of sophisticated, econometric input to our analysis. We think that with these new professionals we will be able to move forward in this area but we feel we should add a note of caution in that there are severe limitations in econometric modeling and in the data requirements for these models. Progress and improvement from this source will be slow.

We are moving forward in other areas as well. To date, most of our work has been on the production and trade side. We are now moving to emphasize the demand side. We have added a specialist in macro-economics to provide our commodity specialists with forecasts and analysis of the general demand situation in major countries.

We are moving to improve our automatic data processing facilities which are important to improving the timeliness and accuracy of the information we provide and we hope will result in a saving of clerical input. This should release personnel for additional analysis. While on the subject of data processing, it should be pointed out that the Reports and Statistics Office included in our Commodity Analysis area provides the data processing and computer support for the total agency. We have recently established an ADP Steering Committee at the Deputy Assistant Administrator level to coordinate this function.

I thank the Committee and the Chairman for the opportunity to discuss the reporting and analysis work of FAS. With me are several others of the FAS staff; we will be pleased to respond to questions.

STATEMENT OF DR. QUENTIN M. WEST, ADMINISTRATOR, ECONOMIC RESEARCH SERVICE, U. S. DEPARTMENT OF AGRICULTURE

I am very pleased with this opportunity to tell you about things we have done to improve the Economic Research Service (ERS). The last three years have been very dynamic for our Agency, just as they have been for agriculture.

We develop economic information for use by public and private decision-makers, and provide it in a variety of ways to a diverse audience.

The audience is wide because our information covers many subject matter areas including farm inputs, farm production, and food processing and distribution as major components of the U.S. food and fiber systems; foreign agriculture production and trade; development and use of land and **water** resources; and the principal social and economic factors affecting life in rural America.

Thus a major part of our program is devoted to providing information on the subjects that were focused on in the Office of Technology Assessment's (OTA) report, "Food, Agriculture and Nutrition Information Systems: Assessment and Recommendation." More specifically, this is "information concerning national and world food production, trade, stocks, prices and disappearance, and on information needed for policy decisions made by Congress, , Federal agencies, State Governments, and agribusiness." (page 3 of OTA report)

The Economic Research Service and its predecessor agencies have a long history as a vital part of food and agriculture information systems. We are proud of our accomplishments and optimistic about the future. We believe that timely, accurate, and objective information on this important segment of our economy will continue to be in great demand for making sound decisions and policies. We look forward to meeting future demands for economic information.

But in the past few years, our task has become increasingly difficult. Many contributing factors have been converging: the depletion of surplus stocks of farm products, increasing concerns about meeting world food needs, rising demand, changes in the structure of agriculture, increased complexity of relationships with the rest of the economy, and scarcity of raw materials.

To highlight how we have been reacting to such challenges, I would like, first to discuss the improvements we have been making in the conduct of economic analysis. Then I will focus on improvements in the timeliness and type of information we provide and on our efforts to improve the flow of data as raw material or input to our analytical process. **Finally I will** touch on further improvements that we feel are most urgently needed,

IMPROVEMENT IN ANALYTICAL CAPACITY

Our basic contribution to the food and agriculture information system is economic analysis. To strengthen this role, we have placed our first priority on improving our analytical capabilities, especially in our major economic situation and outlook programs. This is because we felt the primary problem in 1972–73 was analytical, a conclusion also reached by Dr. Karl Fox in a special report to the Council of Economic Advisers. The OTA report also agrees with this conclusion and further clarifies the problem by stating "the economic models and supply-demand-price equations, which had performed satisfactorily in the more stable conditions of the 1950's and 1960's had little value in the light of the changes which occurred in the domestic and world markets when the size of the 1972 world grain crop became known" (page 40, OTA report).

We have taken three major steps to improve our analytical capabilities. The first was to reorganize the agency so that our resources were more clearly focused on important subject matter areas and to bring the research program into more direct support of the situation and outlook work. A second step was to reallocate close to $000,000 and 19 staff positions to the situation and outlook work and longer term projections program. The third major step was to request and receive about a half-million dollars in additional resources to provide an increased number of highly capable, quantitatively oriented economists.

We have used these additional resources to strengthen the commodity situation and outlook staffs and to establish forecast support units. These units have become the focal point for development of commodity, cross-commodity, and foreign country models that are becoming increasingly operational as a part of our forecasting work. These units are also developing a forecast information system in which documentation and evaluation of our forecasts are an integral part.

Some of our reallocated resources were used to strengthen our capabilities for making longer term projections in agriculture. We now include projections to 1980, 19$5 and beyond as a regular part of the economic information produced by ERS.

Another important change we made during the past three years was in forecast procedures, We have developed a regular program of producing new forecasts each quarter on what we consider to be the most likely assumptions for the three to four quarters ahead. Then we supplement this forecast with contingency analysis using alternative assumptions on such key variables as weather and

levels of exports. The results of these analyses and the underlying assumptions are then discussed in group meetings with other key staffs from USDA, Council of Economic Advisers, Federal' Reserve Board, Treasury Department, and Library of Congress. This interaction helps test the soundness of our assumptions and analysis.

Most of these changes may sound like they are focused on U.S. agriculture. But we have also placed increased emphasis on evaluating the foreign outlook and its impact on the domestic economy during the past three years. As. Dr. Clifford Wharton, Jr. pointed out in his preface to the OTA report, "the growing world interdependency has highlighted the information systems describing that interdependency. Nowhere is this need clearer than in the areas of food, agriculture and nutrition." (p.v., OTA report)

Our domestic and foreign analysts work very closely together on many subjects. In addition, ERS analysts work closely with the Foreign Agriculture Service on questions of foreign agriculture demand, production and trade. Analysts from both agencies serve on Department level commodity estimates committees as well as more recently established committees that focus on the questions of production, demand and trade in Russia and The People's Republic of China. Our analysts have also been fully cooperative with the Food and Agriculture Organization of the U.N. in its development of an early warning information system.

Two specific questions you asked us to respond to concern the use of remote sensing and weather data to estimate agriculture production in those areas of the world where other information is lacking and how we work with CIA information. Since 1972 we have established a separate research area in world weather and crop production. The focus of our recent work here has been to strengthen the use of world weather information in situation and outlook reports and conduct a few selected studies such as forecasting wheat production in Turkey, analyzing the effects of weather on spring and winter wheat yields in the USSR, and studying trends in weather and grain yields in 25 world regions.

Weather data are also used extensively by our analysts in making forecasts of Soviet grain production. Weather indices are estimated and combined with trend yields of individual grains and estimates of areas planted to produce grain production forecasts.

The use of weather data and remote sensing to measure crop production prospects is the major focus of an experimental project our Department is conducting jointly with the National Aeronautics and Space Administration and the National Oceanic and Atmospheric Administration. This project, called the Large Area Crop Inventory Experiment, is a study of the degree to which computer assisted analysis of data acquired from space can contribute to crop forecasting. ERS participation includes the assignment of six people to the project and other support activities such as the preparation of *crop* production calendars to be incorporated into computerized yield models.

Our analysts specializing in such areas of the world as the Soviet Union maintain regular, informal communications with units In CIA working on Soviet agriculture, food, and trade. Much of the information available to the CIA is also available directly to Soviet analysts in the Department, Usually there is general agreement between ERS and CIA analysts on principal agriculture estimates. When different estimates arise, the [differences are examined and discussed informally but there is no attempt to force a common position.

IMPROVEMENTS IN OUTPUT OF INFORMATION

A major improvement has been in our publication program. Most conspicuous is our new monthly "Agricultural Outlook" situation report. This serves as an outlet for brief reporting on our continuing appraisal of the situation for commodities, farm income. farm inputs. foreign production and trade, transportation. and farm-retail price spreads. Our target is to furnish through this new publication frill updates of our forecasts each month to provide our best assessment of the agricultural situation. This would also meet one of the OTA report recommendations that "the Economic Research Service should improve its world information analysis capability by strengthening its ability to analyze, evaluate, and interpret current world information on a monthly basis during the crop growing and early harvest season" (page 9, OTA report).

Other changes in publications to provide more timely information include issuing the report. "Agricultural Supply and Demand Estimates" containing updates about monthly on important basic commodities, going from once a year to three times a year in publishing "World Agriculture Situation" and from annual to quarterly assessment and publication of "Outlook for U.S. Agricultural Exports." This latter one is done cooperatively with FAS.

We have also worked to improve the timeliness of our information through closer cooperation with the Federal Extension Service. The State extension outlook economists can now obtain the most important data in "Agricultural Supply and Demand Estimates" and other situation report summaries through a computer hookup on the same day that we release the estimates. This has made the information far more useful to these outlook economists than when they had to wait to receive the printed publication in the mail,

One of the comments in the OTA report was that our food and agriculture information system is "basically an impersonal, production oriemted system'" (page 6). Although we don't integrate nutrition information into *our* analysis. we have made a couple of other improvements in the past three years that we think are consumer oriented. The first was to greatly increase the detail of our information on price spreads and components of marketing costs. This is an effort to explain more fully the reasons for changes in food prices, who gets what from the consumer's food dollar, and to identify areas of research for improving the efficiency of the system.

A second effort to communicate to consumers is our recent introduction of a monthly TV news service on current agriculture information. We have been successful in getting these outlook oriented features used on prime-time evening news shows in most major television markets.

One area of improving information that is of common interest to ERS and FAS is a more rigorous and systematic appraisal of foreign demand for U.S. agricultural products. We have requested additional resources to establish such a program of continuing information and analysis of the longer term prospects for foreign trade. Our current information on foreign demand is far less rigorous and comprehensive than information on the supply side.

Dr. Paarlberg has already commented about the Department's concerns on obsolescence of agricultural data systems. ERS and the economics profession in general have become increasingly concerned about this problem. We feel that ERS should take the lead in reviewing and changing data series that no longer provide the most meaningful descriptions of food and agriculture. As Dr. Paarlberg has already mentioned, we have had special task forces to assess the farm income and price spread, market basket and market bill statistics and make recommendations for improvement.

IMPROVEMENT OF DATA FLOW AS AN INPUT TO ECONOMIC ANALYSIS

My third major topic is a brief discussion of what we have been doing to improve the flow of data needed to conduct timely and objective analysis. After setting our first priority on improving our analytical capacity, the second priority logically was to develop a flow of data that would fill our most major gaps in data available to conduct analysis with. We set about to identify these major data gaps, determine agency priorities for meeting these needs, and develop plans for meeting these needs. This has included joint planning with other agencies who are major suppliers of the data we use. We added resources in the Office of the Administrator to lead this planning effort and to be in more continual contact on data problems with other agencies.

In looking at our most important data gaps we decided that the first priority was to combine some programs of ERS and the Statistical Reporting Service, add some resources, and implement an annual economic survey of the farming sector. This would provide data for improving our supply response analysis, farm income estimates, capital accounts, consumption of major inputs, and some environmental impact analysis.

A second priority was to start obtaining data that would allow significant improvements in our analysis of the structure costs and performance of the farm input food processing, and food distribution industries. The final implementation of these two plans awaits Congressional approval of the Department's appropriations for FY 197&

Our staff has also done a lot of work in planning how to meet some of our other major data problems. One of these is a continuous survey of consumer food purchases so we can improve our forecasting and analytical capability with respect to food prices through better measures of price and income elasticities and demand shifters. A second longer range plan is to fill in the many economic and social data needs on the use, the changes in use, and potential capacity of our land and water resources. Analysis of the capacity of the U.S. agriculture production sector depends on obtaining more of this type of data.

A third longer range plan is further improvement in the data to analyze the structure, performance, and costs of the input, Processing, and distribution industries. Many important questions on the supply and costs of farm inputs and the costs, services performed, economic concentration, and efficiency of the food processing, wholesaling and retail industries need this type of data.

We still have work to do in improving data on foreign agriculture. We have worked closely with FAS to establish a more complete data base on world production of grains. We have also worked with FAS and FAO to improve informiltion on fertilizer. We are continuing discussions with FAO about more access and use of an extensive supply-utilization information system they have been developing over the past four years. We will be *giving* more emphasis to this area of data needs in the months ahead.

An increasingly important part of our effort for improving data flow is to more frilly apply current computer technology and capabilities in managing and analyzing the large volume of data we work with. We believe that this will free more of our resources for analyzing the important questions and issues. It will also make our staff more flexible and our work less vulnerable to turnover in key staff positions. We recently centralized our data processing activities to facilitate this area of improvement.

FURTHER IMPROVEMENTS MOST URGENTLY NEEDED

These highlights of our improvement activities demonstrate that ERS has been a dynamic agency in the last three years. We have been doing these things at the same time that there has been a sharp increase in the magnitude and complexity of economic issues to be analyzed. We believe that despite the problems we are a much stronger agency then we were three years ago.

So what are the major areas for further improvement? Our first priority is to bring to fruition the plans we have laid out for improving the flow of data. 'This includes both the plans for getting more of the data we need and for more effectively managing and analyzing the data we already use. Our ability to produce timely, objective economic information will be greatly improved when we fill the data needs identified in our longer range plan. Our ability to minimize *obsolescence* in agricultural data systems is also dependent on having the flow of data to draw on for making necessary changes.

I already discussed several of these important data needs. Our most immediate needs are for a continuous survey of food purchases by consumers, a flow of data on the economic aspects of land and water resource use, and data on the structure, costs and practices of the farm input, food processing and distribution industries.

To improve the flow of foreign data, we plan to critique the grains data base improvement work we have been doing with FAS. This should lead to discussions with FAS on undertaking more of this type of work which is primarily to develop a *more* consistent set of data out of the numbers available.

Three recommendations in the OTA report refer to improving foreign information through more support of international agencies such as FAO and through more AID funds for technical assistance in developing data collection programs. We fully support these recommendations as a way to bring almost longer-term improvement in foreign data. But we believe that more immediate improvements are also needed. We plan to enter into more comprehensive discussions on this problem in the near future with FAS and others.

Our priority on improving the management and computer assisted analysis of data will he largely handled by redirection of our current resources. We believe this improvement is needed to free our analysts from some of the more routine aspects of the research process.

As I already indicated, we have placed priority on more complete monthly analysis of the world agricultural situation. *Our* target is that six months from now this more complete monthly analysis will be the basis for material in the '"Agricultural Outlook." We are also planning to devote more resources to the weather-crop production research and continue with our involvement in the Large Area Crop Inventory Experiment.

Our forecast support units are already heavily involved in developing economic models on production, trade, utilization and prices. These are models on major commodities and on countries that are important foreign markets. We plan to move this work along rapidly and add to it the work we will be initiating to provide more systematic and comprehensive analysis of foreign demand.

Other initiatives we have taken in the past three years also continue to be high priority. These include hiring top quality, quantitative economists for our staff, periodic examination of economic and statistical data series for ways to improve their quality and relevance, and continued improvement in the ways we make information available to decisionmakers.

Thank you Mr. Chairman, I will be happy to respond to any questions.

[The following questions were submitted by Senator Humphrey to the U.S. Department of Agriculture and their answers thereto:]

Question 1. At the present time the *Digest of World Agriculture is* a "monthly overview" prepared by junior staff members of the ERS and FAS for internal use only. What, if any, plans do You have for issuing monthly digests of world agriculture under the supervision of senior staff for general distribution?

Answer. The Digest of World Agriculture is used to disseminate information and preliminary analyses of international agricultural subjects to USDA analysts and officials without the full review that is required of formal publications. As such some of the conclusions may be very tenuous and may not have been adequately reviewed in the Department for release to the general public. Some articles have been included even after serious objections from specialists of the subject.

The Digest provides a broad preliminary picture of the current international agricultural situation. Much of the material is issued in official publications of ERS and FAS with very little delay. *Agricultural Outlook*, a new ERS monthly publication, has a section on world agricultural developments. Moreover, international events are given consideration whenever appropriate in the analyses of the domestic economy.

Foreign *Agriculture* and a news release on important events in world production and trade issued weekly and Foreign *Agriculture Circular issued* frequently by FAS give general distribution to information on world development that affect U.S. agricultural trade. *World Agricultural Situation*, which is published three times a year, and the annual agricultural situation reports giving more detail by regions of the world provide more comprehensive treatment of world agriculture.

Other possible ways to provide world agriculture information on a timely basis are being considered as part of a continuing review of the ERS publication program.

Question 2. Would it be feasible and desirable to organize a current food and agriculture intelligence unit made up of key commodity specialists from the Economic Research Service, the Foreign Agriculture Service, and the Agricultural Stabilization and Conservation Service and have them issue monthly world crop reports from the planting season until harvest in the major producing areas of the world?

Answer. At the present time the world outlook and situation activities are performed in two separate agencies. FAS has the *dual* role to expand foreign markets for U.S. farm commodities and provide information on the world agriculture situation. ERS has the role of conducting a Program of economic research to provide information on both domestic and foreign agriculture.

With the increased interdependence between the U.S. and world economies, it has become very important for domestic and foreign analyses to be closely integrated. Analysts from ASCS, FAS, ERS and SRS serve on commodity estimates committees to assess the total supply and demand picture which is then cleared and released through the Outlook and Situation Board. This is an effort to integrate the foreign and domestic analyses. Currently these committees do not give detailed attention to the world agricultural situation except as it implies changes in U.S. exports.

Other Departmental working groups such as the task forces on USSR and PRC and ERS-FAS working groups provide some of the t'ecus needed on current world intelligence. These groups meet frequently concerning information and statistics on world production, trade consumption, and stocks of grains and other commodities.

Mechanisms already exist in the Department, such as the Outlook and Situation Board, to Provide timely information in world agricultural conditions. Some further clarification and coordination of the three Agencies roles and activities coupled with improved data and information systems are appropriate.

Question 3. In order to assure the accuracy and timeliness of information on world commodities, would it be feasible and desirable to create a joint FAS-ERS Board with responsibility for approving the information included in these reports?'

Answer. USDA has an Outlook and Situation Board responsible for reviewing and approving outlook and situation material for the Department. This Board reviews and approves the release of the outlook for U.S. agricultural exports on a quarterly basis. *The World Agricultural Situation,* which is issued three times a year, is also cleared by the Outlook and Situation Board. Since the Outlook and Situation Board consists of members from agencies throughout the Department creating a new ERS-FAS Board would mainly duplicate the functions this Board is already responsible for.

At the present time, much of the information and statistics on world commodity production, trade, consumption. and stocks are also discussed on a regular basis between ERS and FAS. A statistical review committee has frequent meetings to clear statistics on grains. During the very active times of grain production, these meetings are held on a weekly basis. And there are regularly scheduled meetings for clearing statistics of the other major commodities.

USDA task forces have been created to review the agricultural situations in the USSR and the People's Republic of China. The USSR task force makes periodic releases on agricultural conditions and grain production and trade estimates of USSR, generally in Press Release.

Question 4. To what extent have recently increased current economic intelligence activities of international agencies improved the data base for FAS and ERS reports on world agriculture?

Answer. The recently increased economic intelligence activities of international agencies have helped improve the FAS and ERS data base primarily by providing supplementary information about certain countries and commodities which USDA does not collect directly. The international agencies provide a useful check on USDA data as well as provide a different perspective in analysis. Recently increased focus by international agencies on early warning and outlook and situation type of information also provides another perspective that is useful to USDA analysts. The USDA also benefits indirectly in those cases where international organizations have assisted individual countries in issuing new types of data or in improving the reliability and timely distribution of existing data. ERS hopes to develop a more comprehensive and timely data base on world agricultural trade by extracting agricultural trade data from computerized U.N. trade data and thus avoid the complicated and lengthy process of compiling and reconciling trade data from individual country sources.

At the present time, ERS relies most heavily on international organizations-although not necessarily new activities--for ~~in~~ternational monetary and financial information such as balance-of-payments, foreign exchange, financial flow, price index, and national 'account data from organizations like the International Monetary Fund and the Organization for Economic Cooperation and Development

Question 5. There is general agreement that estimates of world demand for food are far less satisfactory than estimates of supplies. What new programs have FAS and ERS undertaken in recent months to improve forward estimates of tile demand for agricultural commodities by countries and regions? What are your plans for strengthening this area in the next year or two?

Answer. The Foreign Demand and Competition Division of ERS has recently undertaken work to improve and expand its effort for making forward estimates of foreign agriculture demand and U.S. agricultural exports. .4 new trade forecast group has been established to develop analytical methods to forecast the aggregate level and commodity composition of U.S. agricultural exports. Further realignment of resources and programs to strengthen country and commodity demand analyses is under consideration. This improved research capability in collaboration with commodity intelligence and expertise of FAS will improve our capacity to make forward demand and trade estimates. These forecasts are in turn imcorporated into domestic commodity and aggregate economic models.

We will continue to improve our trade forecasting capability. ERS and FAS have held discussions on how to improve the longer term forecasts of foreign demand and have implemented some plans toward this objective. For fiscal 1976. ERS requested an increase in its budget of $790,000 to do in-depth studies of demand for U.S. agricultural exports in major country markets. This new research effort was proposed to develop basic economic relationships that affect agricultural production, consumption and trade of food and fiber in foreign countries. This research will contribute directly to forecasting and projecting U.S. agricultural exports by country and commodity. However, Congress reduced our request for foreign market studies from $790,0000 to $290,000, thereby significantly cutting back our proposed research. Although, the new appropriation will allow us to make *some* improvements in our demand studies, additional resources are needed to expand the needs of the type of research.

The Foreign Agricultural Service is also taking steps to improve its capability of making forward estimates of U.S. exports. Recently FAS combined its livestock commodity work into a single division, so that it will be easier to generate and coordinate foreign import demand estimates of feed grains and oilseeds in U.S. exports markets.

Chairman HUMPHREY. Next we have Mr. Hosea Harkness, director of planning, agri-products group, Cook Industries; Mr. Melvin Sjerven, senior editor, Milling& Baking News; and Mr. David Keefe, head of commodity group, Lamson Bros. They will comment on the timeliness and accuracy of United States and world information on Agriculture, based on private -industry experience.

This panel is of very significant importance to us. You can evaluate agricultural information as to whether it's useful, accurate, and of assistance to you in your daily work.

Each of your statements will be printed in its entirety in the record. Plase summarize these in the interest of time.

Mr. Harkness, go right ahead, sir.

STATEMENT OF HOSEA HARKNESS, DIRECTOR OF PLANNING, AGRI-PRODUCTS GROUP, COOK INDUSTRIES, INC., MEMPHIS, TENN.

Mr. HARKNESS. I would like to emphasize just a few highlights, Senator. Frost of all, you made a statement yesterday in your opening comments that "A man's judgment is no better than his information," and this holds very true to the private sector, a company's judgment is no better than the information that it has.

But this information, to benefit everyone, must be timely, and it must be, if not—if it cannot be collected on a comparable basis it must be disseminated on a comparable type basis, so that it is comparable.

I think that in this country one of our greatest problems is the fact that we have the most sophisticated agricultural data collection service that exists in the world in the Statistical Reporting Service. We are so well informed in this country and have been through the years that we try to compare the world, and I'm not saying we don't need the world data. We need it badly, and this is the problem.

I would like to emphasize the outlook and situation board in the ERS, that their reports are the only economic type information that a large segment of private industry has.

Now, we as the company I represent, we have our own staff of economists, and we are doing our own economics work, but we must recognize that there are many people, and companies and organizations which are smaller than we are, who cannot afford to have this type of personnel on their payroll, and ERS is very essential to them.

And once again I want to emphasize, which has been emphasized over the last 2 days, that FAS does do the best job in the world of putting the world statistics together, which doesn't mean that we can't look ahead though to types of improvements.

I would like to just very quickly read through my recommendations.

Chairman HUMPHREY. Go ahead, sir.

Mr. HARKNESS. And to maybe make another comment or two as I go along.

'There is definitely a need for better world statistics on livestock numbers. In a sense, this is a very, very weak area, and the European countries, with Russia, the Chinese, people throughout the world want to put protein on the tables of the populations, and livestock numbers throughout the world become much more important.

There needs to be a continued effort for speeding up dissemination of foreign statistics. They have to be timely and they have to be quick. There has to be more timely release of printed copies of reports. The timelag is too great from the time that the press release is made and the printed copy is available.

Chairman HUMPHREY. That's due to the Government Printing Office. I don't think that we have updated the technology of the Government Printing Office to take care of the tremendous additional requirements.

You know, every report that you people have to fill in they have to print up there. We should take a look at what Mr. Harkness has said about the printing of material.

Mr. HARKNESS. OK, I would like to see an effort to encourage USDA personnel to better understand statistical agencies in other countries, I will point out that just a little bit later.

I would like to see-I think that it is for the benefit if there would be an elimination of some of the apparent duplication of effort by the ERS foreign analysis group with FAS taking over this total function.

And this stems from even myself as an individual asking questions and finding-and I think they are coming closer together in acknowledging that each other exists, but in years past, asking questions, and one saving, "Well, we have our own series of data and we don't agree with the other." There was a duplication of effort where they didn't get together.

OK, support for continued research methods in understanding and supplying timely intelligence for world information.

Continued support of SRS sampling and yield research, especially methods for improved techniques for early season forecasts.

Chairman HUMPHREY. Yes.

Mr. HARKNESS. And support of continued investigation of remote sensing such as the LACIE program, so that when remote sensing is an operational tool, the USDA will be able to utilize it on the domestic and foreign scene.

And then my last point, which you have read a couple of times concerning the world crop reporting board, and I would like to give a little bit more detail here of what I am proposing here, or more why I am Proposing it.

First of all, I do not think this is a time-consuming thing. I think we can look at SRS and if you lock people in a locked room at 5 o'clock in the morning, they are going to get the job done by the end of the day. In other words, in SRS and the crop reporting board, there's a difference of opinions inside those locked doors, 'but that report comes out, find comes out quickly, and it one number, and you do not hear one individual saying, I believe such a number and another one saying I believe there's one number and this is one of the chief things I'm after here. is that we do not need a State Department number, we do not need a CIA number, we do not need an FAS number, we need one number.

If we would go back and take the 180 and the 210 on Russia and we would have been better from a user community to have had a number half-way in between, or had them come to an agreement on which number was best.

Chairman Humphrey. I think that it greatly depends upon the clearance procedures that you have. If the Secretary of Agriculture, were chairman of the World Board, and the clearance procedure required that within 24 hours all documentation must be cleared, this would eliminate the business of having everyone initial the report.

Have you ever seen one of these documents that clears the Government ? Everybody from the fellow that's emptying the wastepaper basket up to the man that's going to call on the visiting head of state has to get his little initials on the side, and of course, they are out of town half the time. That's been the problem with clearance procedures.

Go ahead, I'm on your side.

Mr. HARKNESS: I have one last item—

Mr. DESIMONE. Before we go to that, Mr. Chairman, may I suggest that the wording in the recommendation-"we could eliminate duplicate numbers floating around in the Government"- is confusing.

I think perhaps part of the problem that Dr. Paarlberg and others have had, is that what you really mean is that there are confiding numbers, not duplicate numbers.

Mr. HARKNESS, YES, OK. .

One other point I'd like to bring out under No. 9, and this is No. 4, and the reason I put No. 4 about understanding statistical agencies in other countries is I have traveled in other countries and I hunted out the person who was the administrator of SRS-type persons in other countries and tried to understand their statistics system, and they then—I know what their official number is, and I know in my opinion--and this is strictly my own opinion—how much confidence I would put in that number, and some of these countries that have very, very high confidence in their statistical repenting systems-but when the FAS report comes out, which has been based on attaches' analyses and so on and so forth, it would be a number entirely different, because they don't believe it.

I think that there is not an understanding hereof what makes a good statistical system within a country, and we have some systems in the world which have-which are as good as the United States. They are not as timely, but they are as good. They may be 1 or 2 years getting the information out, but the data, as it was collected, was collected with very, very sound statistical bases.

Chairman HUMPHREY. I think that's a very worthwhile recommendation.

All right, are you through with your statement ?

Mr. HARKNESS. I'm through, yes.

Chairman HUMPHREY. Thank you.

[The prepared statement of Mr. Harkness follows:]

STATEMENT OF HOSEA S. HARKNESS, DIRECTOR OF PLANNING, AGRI-PRODUCTS GROUP, COOK INDUSTRIES, INC., MEMPHIS, TENN.

We, as an international trading company, live day by day with the agricultural statistical information which is available from all sources we can locate worldwide. Plus, we continuously attempt to verify by our own intelligence where data is being released untimely or is totally lacking.

Data, to be of the most benefit, must be collected in a comparable manner and must be released in a timely manner. Both of these factors play a key role with the organizations under discussion at this hearing.

I would like to take these organizations one at a time and begin with the Statistical Reporting Service. This organization is the most sophisticated agricultural data collection service in the world. Reports are released with a timeliness that exists nowhere else. Quality of the forecasts and estimates are unsurpassed. The most criticism expressed against SRS is by individuals or groups who, in my opinion, don't understand the system. Improvements undoubtedly can be made but these become minor when you look at other informational areas worldwide which lag far behind.

On the domestic scene, let's look at the Economic Research Service. Prior to late 1872, the Situation Board issued scheduled reports that would spell out the situation when released but generally did not look ahead and were quickly outdated. As a result, the Situation Board and staff were frequently lagging far behind the current events and had no reason to catch up until the next regular Situation report was due for release. A large segment of private industry depended on this service, and as a result were not being kept up to date on the domestic situation. Since 1972, the Supply-Demand estimates released when there was a new major crop number published have forced the Situation Board to become more realistic and to keep up to date. As a result, these analyses have become much more useful to the public.

Each Supply-Demand Report needs to be broadened to give further explanation of the component parts of the supply-demand balance tables. For example, when changes are made in domestic usage, they need to be quantified. We need to know if that domestic change was the result of livestock feeding or was it because of a change in mill consumption or other non-feeding reasons. Such as, on September 12, 1974, the Supply-Demand report indicated that the feed usage of corn for the 1974-76 season would be 3,73%3,859 million bushels. On October 11, 1974, following the October 1 crop report, the Supply-Demand Report indicated 1974-75 corn feed usage at 3,487-3,607 million bushels, which represented a change of 250 million bushels from September. The October report made the inference the reduction was the result of declining production. However, the report did not state if the reduction was concerning the number of livestock on feed or the rate of feed the livestock would receive. Livestock number and rate of feeding are both a basic part of the corn market.

Now for the Foreign Agricultural Service, it does the best job in the world of putting world statistics together on a *comparable* basis. They have speeded up their release of data considerably since 1972. Prior to. the 1972 crop season, information on a given country might be two-three months old before released. Information supplied in attache reports might be a month old when submitted, then the FAS circular was released one to two months later. Statistics are almost meaningless if a report indicates the corn crop in a given country is doing excellent but by the time the information is released two months later, the crop has deteriorated sharply due to a severe drought or crop infestation, To a certain degree, these problems have been overcome. The development of country balance tables have been a major improvement in giving a more comparable picture of the world situation. The analysis of the USSR situation has been good information for public consumption; however, a reluctance to change as quickly as conditions might indicate has been noted. All in all, we feel good effort is being made to feed information quickly to the public.

The export commitment reports are overall fairly good except for Western Europe, where speculative buying by countries keeps the actual numbers less certain.

Recommendations, as we see them, for improvement of agricultural information systems are:

1. The need for better world statistics on livestock numbers.
2. Continued efforts for speeding up dissemination of foreign statistics.
3. More timely release of printed copies of reports. The time lag is too great from the press release to the printed report release.
4. Encourage an effort for USDA personnel to better understand statistical agencies in other countries.
5. Elimination of some apparent duplication of effort by the ERS Foreign Regional Analysis Group with FAS by combining these functions under FAS.
6. Support for continued research methods in understanding and supplying timely intelligence for world information.
7. Continued support of SRS sampling and yield research, especially methods for improved techniques for early season forecasts.

8. Support of continued investigation of Remote Sensing such as the LACIE Program, so that when Remote Sensing is an operational tool, the USDA will be able to utilize the system both on the domestic and foreign scene.

9. A World Crop Reporting Board be set up within the USDA that would review all sources of country production information (attache reports, foreign released statistics, weather-yield analysis, check data, etc.) from all departments of government on a timely basis. This Board would set a forecast or estimate that would be acknowledged within government (USDA, State Department, etc.) as the best number. Thus, we would eliminate duplicate **numbers floating within government. This would eventually** lead to more credibility for the private user.

Chairman HUMPHREY. You may proceed, Mr. Sjerven.

STATEMENT OF MELVIN S. SJERVEN, SENIOR EDITOR, MARKETS, MILLING & BANKING NEWS, KANSAS CITY, MO.

Mr. SJERVEN. I am Melvin Sjerven. I don't suppose there is a publication outside of Government, outside the Government Printing Office, that uses more of the crop reports and the information of the Department of Agriculture than we do, and I want to say that some of the misgivings that we have about information, as mentioned in my statement are being corrected, and I think the people in the Department should be commended for what they are doing to correct errors.

And the other thin that hasn't been mentioned is the openness. If there's information that they can tell us, we can talk to the people in the department, and discuss with them how they arrive at a certain evaluation.

I certainly agree with both of these witnesses, and what they have to say about the information services. From our point of view I did want to touch on domestic utilization a little bit, and I did that at some length ***in*** referring to the study which I won't even go into, but it's an example, I think, of the important informational service on the domestic side. I think it's easy for us to get all tied up in looking at export projections and carryover projections and not to pay any attention to nutrition and the domestic side of business.

The study itself, entitled the Schnake-Leath Study, recognizes one limitation, and there is another study of the household food consumption survey which incredibly comes out every 10 years, and it ranks with the Bureau of census and Manufacturing as being an untimely report, and hopefully something will be done about that on the domestic side, or at least that these kinds of studies will be done in some particular place other than the household consumption survey.

But certainly once every 10 years is not enough to publish that kind of domestic utilization information. About the number of reports-if there was in 1972 a scarcity of information about what was going on, we may have a surplus of information now, and maybe the effort is to eliminate all surprise., and if that's the case, we question whether that in itself is a desirable goal, unless uncommon confidence prevails in the accuracy of those projections.

While we would commend FAS and ERS for their data, there is one report that causes a lot of problems-one conflict of reports, and that is the conflict between the exports as reported by the Foreign Agricultural Service in their Weekly U.S. Export Sales, and actual inspection as reported by Agricultural Marketing Service. There was a 53 million bushel discrepancy at the end of the crop year. Well, anyone who is using one or the other of those reports, you could see what it would do to your carryover.

I notice this year's total, the first 2 months of the crop reporting that those two figures are very close together. Now, maybe somebody has already corrected that, I'm not sure.

Chairman HUMPHREY. Yes; that is something we should check into.

Mr. SJERVEN. The things that I have in my statement are exclusive of flour.

Chairman HUMPHREY. Yes.

Mr. SJERVEN. Flour is even worse, but it's a smaller amount. Flour is even worse though. Flour is 40 million bushels exported, and I think the export sales show them much higher than that.

So that becomes difficult. And in defense of FAS, I guess I can say that they always put a cautionary statement on there saying that it's a mistake to add these things together and come up with that, but then they proceed to do it themselves in the report. And we do that.

Getting back to what Mr. Harkness said, too, if you have conflicting numbers floating around, both numbers have the imprimatur of the Department of Agriculture and any newspaper, any publication like our own that picks it up and uses it, we explain it, but I'm not sure really how many people read the explanation. They look at the tables, and this is a figure that has imprimatur of the Department of Agriculture and that's what they accept it as. And that much of a gap is too much.

We certainly hold a high regard for the integrity of the Statistical Reporting Service, and nothing was detracted from the intense interest in the reports, but I do have one interesting and almost amusing little objection from our friends in our part of the country, Mr. Humphrey.

Arizona is probably going to replace Montana as the second largest producer of durum in 1976, and it isn't even listed as a durum-producing State in the crop report.

Chairman HUMPHREY. I would like to include this in the questions we'll be sending to the Department officials, and tell them I am doing this on behalf of Barry Goldwater.

Mr. SJERVEN. There is enough acreage contracted in Arizona this past year so that it was very close to Minnesota in durum, but it's probably going to replace--and it's fall-seeded durum.

Chairman HUMPHREY. Yes.

Mr. SJERVEN. And our macaroni manufacturers wouldn't like it very well, but the Italians would like it and the exporters are selling it.

Here's another problem; you see durum is a small crop, and here is durum that is not produced according to the production report, but it is exported according to export reports.

Chairman HUMPHREY. Very interesting analysis. This is the kind of thing that we should bring to the attention of the Department.

Mr. SJERVEN. The Census of Manufactures, as was discussed, is untimely. It is a fine benchmark report, I can't say enough for it, but it just is untimely when you get it.

This is not in my statement. It has come up since I issued the statement, and is a matter of concern to me in the area of information, and that is the manner in which the ban on exports was extended to Poland without the knowledge of the Department of Agriculture. What in the world does it do to our understanding of the flow of information if we have a projection of what exports are going to be in another department of the Government, and it can intervene or does intervene and say that this is the way it's going to be. The same thing applies, to some extent, to the negotiations of long-term agreements. If that is a State Department function without coordination or equal status for the Department of Agriculture, we worry about what it does to the flow of agricultural information.

Chairman HUMPHREY. Also, I think it poses the problem in reference to what we call regular customers. If we have a decline in production, and we have an agreement on the fulfillment of certain levels of a crop, or of exports, what do we do? Is this amount taken out of the domestic market at the expense of the American consumer? Or are the amounts sold to regular customers like Brazil, Japan, and the United Kingdom reduced ?

Mr. SJERVEN. Well, Senator, I guess the first thing you do in negotiations is negotiate an escape clause in it. In 1974-75 we couldn't have exercised the 10-million-ton minimum agreement with the Soviet Union.

Chairman HUMPHREY. That's right.

Mr. SJERVEN. Look what we've done to the carryover of wheat and corn, and if we had a 10-million-ton agreement with the Soviet Union in 1974-75 we would have had to use an escape clause, and I assume if we have that kind of an escape clause, they would want an escape clause for when their crop is too big.

In other words, the only time this kind of agreement really works is when you don't have to use it.

But it does affect information. because, as you say, if we have that agreement, then what about those other customers, those other traditional customers, what about the American consumers.

And it affects our total information system. And one other point quickly and that is Dr. Paarlberg also gave a very important speech, I thought, last week in which he indicated that the agricultural establishment has lost the ball in establishing farm policy, and the agricultural establishment he described as the Department of Agriculture, the congressional committees on agriculture and that the new agenda on agriculture has as its No. 1 item, food prices, and specifically how to hold them down.

Now, if that be true, what effect does that have on what projections really mean. because in my mind that means that somebody back here is going to be sitting there with a price limit in mind" to the farmer, and when it reaches that level we have to do something about it.

Chairman HUMPHREY. Well, if that's going to be the policy, at least it should be debated and decided upon. If we're going to have a maximum on price, as well as a minimum on price, and a maximum on production as well as a minimum, these are things that should be decided on as policy issues by the Congress of the United States in consultation with the appropriate departments of Government.

Mr. SJERVEN, Thank you, Senator.

[The preparedst@=t of Mr. Sjerven follows:]

STATEMENT OF MELVIN S. SJERVEN, SENIOR EDITOR MABKETS, MILLING & BANKING NEWS, KANSAS CITY, MO.

My name is Melvin S. Sjerven. I am senior editor for markets of Milling &I Baking News, a weekly trade magazine for managers in grain, billing and baking' industries.

In addressing the question of what improvements in the Foreign Agricultural Service and the Economic Research Service have been made since 1972--1973, and what further improvements are feasible, we would want to state at the outset that we have been very much impressed with improvements over that span of time, and that commendation is accompanied by strong urging of further improvements. A case in point claimed much attention in our publication in recent weeks and I would like to discuss it in some detail as one example of the kind of improvement we have noted. -

Rarely are editorials in Milling & Baking News continued beyond a single page and in nearly all issues two editorials make up that page. But, scheduled for publication in our issue of Oct. 7 is an editorial entitled "A Landmark Study." That this editorial will fill the page plus half of another gives some indication of the significance we attach to the study. May I read the introductory paragraphs of that editorial?

"Consumption analyses recently issued by the Economic Research Service of the U.S. Department of Agriculture fill a void in data about flour and baked foods usage that rank publication of the information as an important turning point in breadstuffs knowledge. Published in detail in the August 26 and September 2 issues of this journal, the study provides facts about past and current flour consumption trends of a type and of a value never before available. Of even greater importance than the information about the past and present are the clues that the study presents on future flour consumption trends. When combined with the information 'mined' from the 1972 Census of Manufactures for flour milling and baking, which have been extensively reviewed in a number of earlier issues, it would appear that breadstuffs marketing managers have more reliable and more productive statistical tools available to them currently than ever before.

"On this score alone, the industry owes a great debt of gratitude to the study's authors, both young holders of doctorate degrees in agricultural economics. Dr. L. D. Schnake is stationed at the Grain Marketing Research Center at Manhattan, Kansas, the federally-funded facility charged with studying all aspects of grain and products markets. Dr. Mack N. Leath is with the Prairie Village, Kansas, office of the Agricultural Stabilization and Conservation Service, where he is project leader for systems analysis in the Grains Program, Area. Many people probably need to be thanked on behalf of the industry for encouraging this pioneering work. Right at the top are Dr. Quentin M. West, administrator of Economic Research Service, and Secretary of Agriculture Earl L. Butz. Gratitude for the study is accompanied by voicing of the hope that the work will be funded for continuation."

Obviously, the Schnake-Leath study struck a responsive chord in the editorial offices of our publication, which we reflected in the amount of coverage we gave to it. The innovative efforts involved, in our opinion, go right to the point of these hearings into the timeliness and accuracy of current information on agriculture. This study recognizes the limited usefulness of the Household Food Consumption Survey, which has been the major source of information on wheat products consumption, but which is published only once every 10 years. Our excitement over this study also reflects the importance to domestic users of grain and to the growers of the data provided by the various branches of the Department of Agriculture.

Also in the domestic utilization area, we see the need for more attention to wheat feeding in particular and animal feeding in general, instead of treating such usage as residual.

In milling and baking, there is considerable discomfort over whether we have a problem of iron deficiency anemia in this country, or whether that situation has been politicized. We suggest that the measurement of nutritional well-being ought to be assigncd to somone.

Turning to the issuance of projections, estimates and reports generally, in our opinion it can be said that if there was a scarcity of information in 1972 there is almost a surfeit of information in 1975. Once issued, forecasts tend to become subjective and, with an increased number of forecasts, sometimes it appears that the forecasts themselves have a multiplier effect on any problems involved. We sometimes wonder if the issuers of a proliferation of projections at times are not under pressure to eliminate all surprises. We question whether that in itself is a desirable goal unless uncommon confidence prevails in the accuracy of the projections.

With a few notable exceptions, we find the current informational reports of . the Department of Agriculture to be timely and accurate.

We do have a few significant problems.

One of the more troublsome is the conflict between wheat export inspection data as provided by Agricultural Marketing Service and accumulated exports as reported by Foreign Agricultural Service in its weekly issuance of '*U.S. Export sales." Export inspections data as published in "Grain Market News" showed July 1974-June 1975 wheat exports, exclusive of flour, at 993,236,000 bus. The total shown in "U.S. Export Sales" was 1,045,900,0(M) bus., also exclusive of flour. That disparity of 53 million bushels is enough to throw out of kilter evaluations of data using one or another of the reports. Careful reading of the report reveals that Grain Market News figures are inspections as reported by A.M.S. and that U.S. Export Sales figures are reports by exporters to F.A.S. Nevertheless, both are published with 'the imprimatur of the Department of Agriculture. We have noted that thus far in the new crop season the two figures are closer *together.*

The seriousness of the kind of problem I have just described is that the conflict in Information, even though it can be explained as coming from different sources, has a deleterious effect on the credibility of other information issued by U. U.S.D.A. We think a need exists to coordinate information derived by the various agencies before releases are made.

We hold in high regard the integrity of the publications of Statistical Reporting Service. Nothing has detracted from the intense interest concentrated on its monthly estimates of crop production. Those estimates are based on the con. dition of crops at the time of the S.R.S. survey, "and assuming normal weather will prevail for the balance of the crop growing season." Recent yearn have shown that the assumption of normal weather is often misleading and perhaps weather technology will provide an alternative.

Crop production data also do not reflect the expanded durum crop of Arizona. Based on reports of contracted acreage, it appears that Arizona could emerge in 1976 as third or even second largest producer of durum after North Dakota.

We find very valuable the situation and outlook reports of Economic Research Service. We would encourage expansion of studies dealing with domestic wheat utilization by class and, again, treating livestock feeding in greater detail.

Census of Manufactures reports as issued by the Bureau of Census provide valuable benchmark information, but they would be much more valuable if issuance were more timely.

We are aware of advanced technologies, such as remote sensing and analysis of weather data and urge more research and applications, but thus far we have seen few timely reports emanating from utilization of the technologies.

We find the World Grain Situation publication of Foreign Agricultural Service of great interest and of improving value. Sometimes its evaluations differ significantly with the international Wheat Council, but we find the data of special interest. Tracing the deterioration of the U.S.S.R. grain crops claimed special attention this season. Question arose from time to time whether F.A.S. lowered the Soviet estimate as much as its information indicated because of concern over the credibility of a report sharply lower. But certainly it must be said that information on Soviet grain production-and grain production around the world—was made available much more quickly than in any previous year and for this the Department should be commended.

"Certainly advances in information technology should be pursued and utilized to a maximum in view of the tightening of the world food situation in recent years. We feel that government agency responsibilities should shift from providing a proliferation of projections and estimates to a coordination of information with special emphasis on consumer needs. In the process, some shifting of respon-

sibilities among the agencies would undoubtedly be in order. Certainly, conflicting data should be reconciled as much as possible.

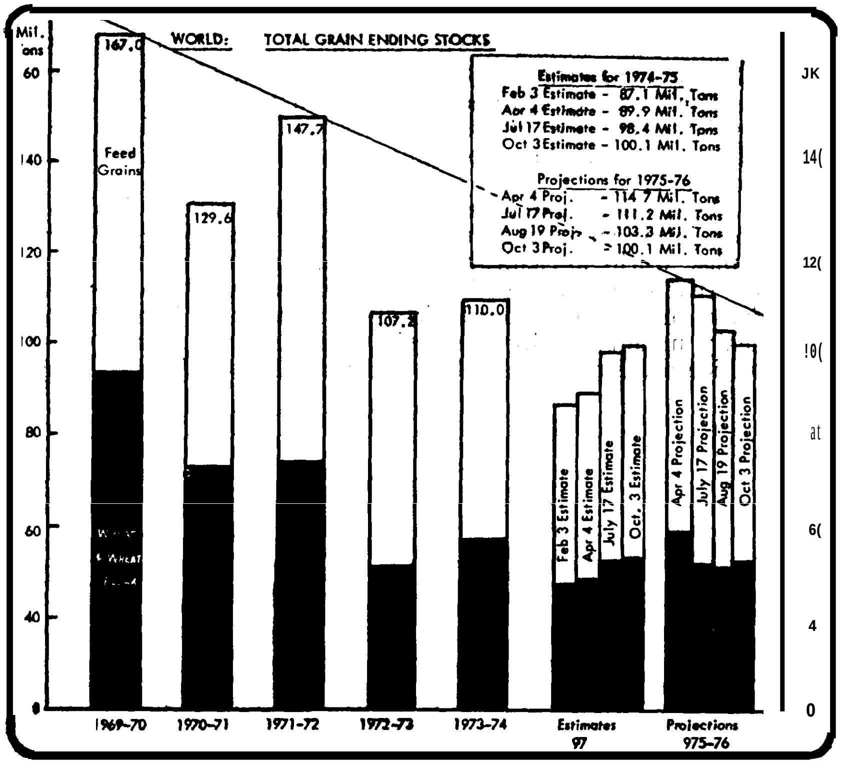
Our best hope is that hearings such as these will lead to further refinements in information systems. We feel that great progress has been made since 1972, Thank you for providing us this opportunity to express our views.

Chairman HUMPHREY. Mr. Keefe, please proceed.

STATEMENT OF DAVID KEEFE, LAMSON BROS., CHICAGO, ILL.

Mr. KEEFE. Since you are talking about a shortage of time, I'll try to be brief. Actually, several good suggestion have already been made in the information submitted by m fellow witnesses. Also, to be very frank, the presentation by key USDA officials yesterday and today confirms that they have already aggressively initiated programs to improve on the accuracy and timeliness of reports on the world food situation.

One thing I'd like to submit in which we have put together on this world food situation is a graph depicting a gradual decline in world carryover of food and food grains stocks since 1969. We have found a great deal of interest in this at seminars in the Midwest, especially among grain dealers and farmers you referred to earlier. I would like to pass out a few copies of this graph to show that if one does put a limit on exports, and in effect a limit on price, a potentially dangerous situation could develop within the next few years regarding world food supplies.



Just real quickly, since 1969 the world food and feed grain supply has basically been trending downward to a point where last year, corn went to a record price of $4 a bushel and so beans went to $9 because it looked like we were going to have the smallest carryover in recent history, certainly on a per capita consumption basis. The things that helped avoid this and caused grain prices to eventually decline were the tremendous reduction of livestock feeding and a few other abnormal developments such as the limitation on export business with Russia.

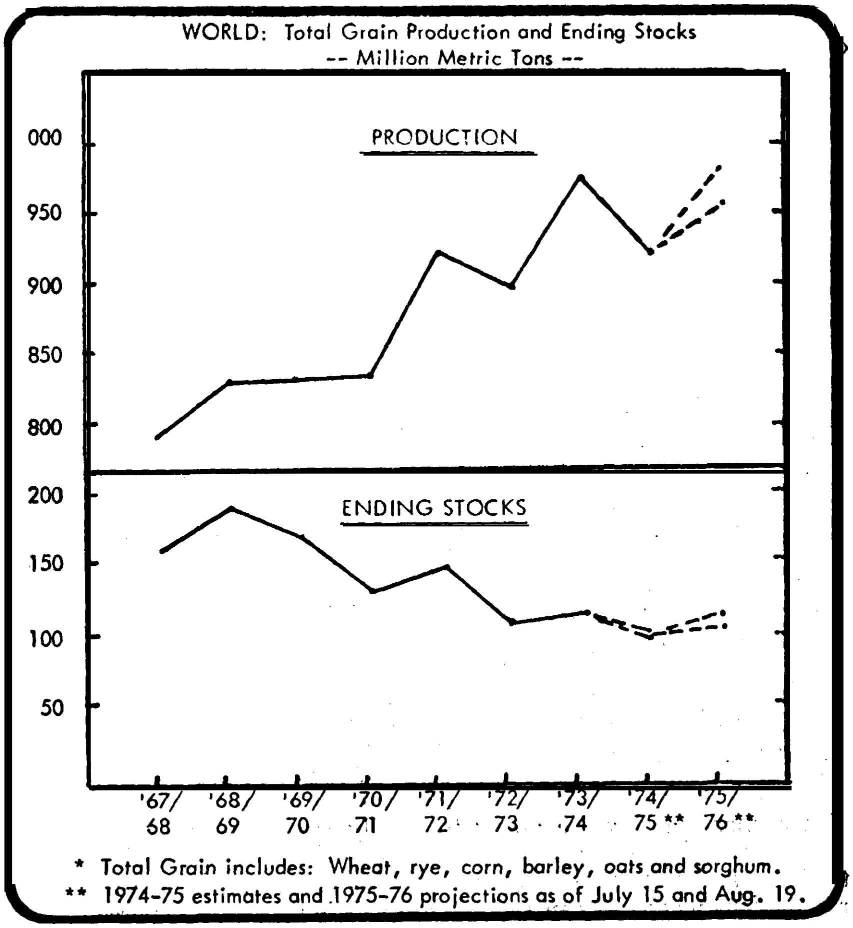
Also of major significance was the prospects of a record crop this year which looked like it was going to bring up this low carryover of roughly 85 million tons up to about 125 million tons, hopefully ending this downtrend in world stocks.

However, with the recent cuts in the 1975 crop in U.S.S.R. or U.S.A.,. you are back down to what Assistant Secretary Bell said yesterday, "to a point where stocks probably won't increase this year." Frankly, I think some people feel that if prices stay at the current relatively cheap levels you may even have a further decrease in stocks by next summer.

Then the point comes up, what if you put an upside limit on prices and we do not expand production next spring? If you get another bad crop, what is going to happen? We do not have another 80 million tons to lose now in the food reserve like back in 1969. Hopefully we'll have good crops next year to build back up the reserve that Assistant Secretary Bell has indicated is likely to happen, if not next year, by 1977-78.

"'But there is, as you've probably heard, some strong predictions from some prominent meteorologists that you may have trouble again next year 'with weather in the major world crop areas. If we do, I think putting a limit on exports and therefore on prices in this area, is extremely dangerous. I would much sooner pay a higher price for food And be able to, than have someone put a limit on price and discourage production here.

That's, about all I have except to say that the USDA is doing a tremendous job in surveying and reporting on this rapidly changing and complex world agricultural situation. The one thing I would suggest is that maybe more of this voluminous data be presented in graph form, such as the one submitted here. It would be more easily and quickly understood by the grain trade as well as the general public, which needs to have a better understanding of this situation,



Incidentally, one other graph that is a way of looking at this thing, is that world production has been expanding and even with that, the carryover stock is going down because per capita consumption is increasing. We personally have had a lot of talks with farmers and grain elevators and feed and food processors and users. They all tend to say that before we, as a nation, agree on something like export controls which will discourage next year's crop production let's look what is happening to food reserves; and let's get this reserve built up, before we tell the farmers we're not going to allow further exports, and thus reduce or eliminate their profits, which is kind of what sounds like might be happening at high levels here in Washington.

Chairman HUMPHREY. Yes, you mean the limitation on price?

Mr. KEEFE. The limitation on exports which has a bearish impact on price. If corn prices go up should Government be able to cut off exports. My own judgment would be that an adequate supply of agriculture-food-commodities is too critical a factor in the life of society throughout the world for any group, however smart they might be, to decide whereto place a price limit on food.

Chairman HUMPHREY. I want to say that I have the greatest respect for the people who try to manage and conduct our foreign policy, but to understand agricultural economics is not exactly a simple trick, and it isn't something that you get by being in the diplomatic sections of our Government and the State Department. This requires a great deal of experience and also keen insight into the makeup of the farmer.

Mr. SJERVEN. Senator you've preached the gospel of reserves for how many years at the annual GTA meeting in St. Paul? I don't know how many years.

Chairman HUMPHREY. I started in the 1950's.

Mr. SJERVEN. And you—

Chairman HUMPHREY. And I tell you, we are coming closer. You would be surprised. I had a meeting yesterday with Senator Bellmon about this. We've been sitting on two sides of the table here arguing about reserves, and now we're just about that far apart right now. You can just about slip a little piece of paper in between, When we get it locked together we're going to put a high and low block on this government, and we're going to finally get a reserve program. It would basically be farmer held, The only time the farmer has to pay that interest charge is when he sells his crop. We'll have a trigger mechanism where he can sell his crop, let's say, at 150 percent of a good loan rate, or so.

Mr. KEEFE. Yes.

Chairman HUMPHREY. When he gets the price, then he's capable of paying for storage charges and interest. The only time that the Secretary could release any of that crop under the loan program is when there is 200 percent of the loan rate. I don't trust Secretaries that are under constant political pressure to pull the skids out from under our producers

We've got a big battle going on here about this, I've got friends on both sides. Our friends that are in what they call strictly consuming States, assume that the protection of the consumer is by the protection of the price.

Mr. KEEFE. Yes, right.

Chairman HUMPHREY. Well, that is a protection for the consumer, if you can get anything to consume.

Go ahead.

Mr. KEEFE. Excuse me, Senator. Just one example of that is the current hog situation. We have the smallest per capita hog supply since the depression.

Chairman HUMPHREY. Yes.

Mr. KEEFE. Bacon is now $2.50 a pound, and partly because of this price control thing of the past 2 years. Especially the farmer, he will react so strongly against that. If he was less independent. I guess it would be different. But he has reacted so strongly against price controls we *now* have a meat problem in this country, and we could have a problem in grain if we restrict exports and if we don't get good weather next year. Hopefully everything is going to be OK, but I'm just saying we're approaching a minimum supply situation which suggests we have to be very careful.

Chairman HUMPHREY, We also have the problem of feed prices for farmers. After all, farmers are the greatest consumers of feed grains. one of the reasons that I've always advocated some kind of a reserve was that it gave the farmer, who uses the feed grains, an assurance that there was a supply.

Mr. KEEFE. Correct.

Chairman HUMPHREY. The biggest problem for these farmers is they get up on the mountain and then someone pulls the trap down below and down he goes into the bottom.

I believe that there are some questions we wanted to ask these gentlemen.

Mr. CORDARO. I have one question, Senator Humphrey.

Chairman HUMPHREY. I will have to leave in a few minutes but I want you to continue. And I want to thank Charles Frazer of the National Farmers Organization, Jerry Rees, of the National Wheat Growers Association, Gene Hamilton of the American Farm Bureau, and Reuben Johnson of the National Farmer% Union for being with us today. You all have prepared testimony, do you not?

Mr. HAMILTON. Yes, sir.

Chairman HUMPHREY. Your prepared testimony will be made a part of the record. I would like you to know that we will pass on to USDA your concerns.

Go ahead, Mr. Cordaro. Is it all right with you if we proceed that way ?

Mr. DADDARIO. If you would like us to, Senator, we certainly shall.

Chairman HUMPHREY. I think we should. I have to be on the floor of the Senate, but you may proceed under my authority. Thank you.

[The prepared statement of Mr. Keefe follows:]

STATEMENT OF DAVID KEEFE, LAMSON BROTHERS, CHICAGO, ILL.

I am David Keefe. general partner and head of Lamson Commodity Group.

Lamson Brothers is a 101 year old New York Stock Exchange member firm, headquartered in Chicago, with branch offices throughout the corn belt. Approximately half of our total revenue is derived from commodity futures business, which is predominantly grain and livestock due to *our* geographic location and long history in the cash grain business.

Our primary objective is to service our large commodity clientele via *proper* execution of commodity futures orders and timely information regarding pertinent developments affecting commodity markets. Any comments I make regarding the timeliness and accuracy of agricultural information are my *own* and are to be considered in the light of Lamson's primary objectives. Please understand that I am not a spokesman for the Chicago Board of Trade.

A. SUMMARY OF COMMENTS

1. The analysis and publication of outlook information should be consolidated under one agency, probably ERS.

(a) World food feed grain summaries and outlook reports should be updated monthly.

(b) The complexity and extent of data required in the commodity area is such that many observers are unable to benefit from it. Therefore, more simplified graphs or charts should be used to summarize pertinent changes that may occur on a monthly basis, for marketing participants and consumers via various news media.

2. The USDA has done an admirable job of adapting to the dramatic changes that have occurred in the world food/feed grain situation in the last three to six years.

(a) However, these changes have created a situation in the commodity markets where risks have increased significantly.

(b) Therefore, staff, organization and budget changes to meet this new need " should receive high priority in the months ahead. Far too few people understand the serious changes in our world food supply situation that has occurred in the last few years.

Mr. CORDARO. I would like to introduce Mr. Daddario, who is the Director of the Office of Technology Assessment and Mr. De Simone, who is the Deputy Director. I just have one question that I would like to ask you all to comment on.

There seems to be a general feeling that the private sector is better able to estimate what's actually happening in the world. I know that many people felt Milling and Baking News was on top of the 1972 and 1973 wheat sales long before they were being reported by USDA. There are also many people that feel that the five or six top grain companies have a much better idea of what the supply and demand situations are because of the analytical techniques that they employ.

We are interested not only in how you use USDA's information, but if their analytical techniques are devices that you employ, such as the computers.

Mr. SJERVEN. We have spies.

Mr. CORDARO. It's that simple?

Mr. SJERVEN. The reason that Milling and Baking News was ahead of the Department of Agriculture and we were telling the Department of Agriculture what was going on if they would listen, is that the Department of Agriculture at that time had a hands-off policy. They had surpluses and they were paying subsidies and they wanted to get rid of the grain, and they had no idea that these sizes were there. Now, I'm convinced absolutely that no one in the Department of Agriculture, no. one in the government had any idea how much grain the Soviets were going to buy in 1972. We were paying subsidies and once the business was underway, there was contrary to-almost a 180 degrees difference from the current situation and there was at that time not a special desire to know what was going on.

There was the feeling that we've got all the grain we need, and the reserves and bins are full all over the country, why worry about it. Just let the business get down, the subsidy payments will tell us how much is done, and we'll know.

There was just a real desire to avoid knowledge about the grain business and what was going on. Now, of course, it is just the opposite? and you have the Department of Agriculture doing a fine job of fine tuning and orchestrating what is going on, and whether it be monitoring. or whether it be approving or disapproving of it.

Mr. CORDARO. As a reporter, when you are confronted with conflicting estimates--one from USDA and another from CIA—what kind of analytical techniques can you employ to try to resolve the discrepancies?

Mr. SJERVEN. Well, we have to rely on incoming information. We don't have computer technology and that sort of thing. We use Mr. Harkness' computers. No, we have contacts with—I really don't mean that. That shouldn't go in the record.

We have very close contacts with everyone in any kind of business having to do with grain and flour, and so we get our information from them, and I assume that they are gathering it through their different ways of doing it and we rely very heavily on the Department of Agriculture. We think very highly of the information which the Department puts out.

Mr. CORDARO. Do you feel that there is any information that the I)epartment is disseminating that is redundant or should be eliminated ?

Mr. SJERVEN. Yes; I had in my statement some specific items. A couple of places there I think I suggested that rather than more proliferation of reports, that somehow more important to me right now is to be sure that the reports are reconciled, where you don't have these conflicting numbes.

Mr. CORDARO. Then you would support Mr. Harkness' recommendation?

Mr. SJERVEN. Yes, right.

The other thing is that once a report is made it becomes subjective and that's in my report as well. And then when a regular report comes out and an agricultural supply and demand report follows it, then maybe it's timely. But then comes a wheat situation, which has already been made out of date by the agriculture supply and demand estimates which were put out 2 days earlier, or something like that. This was al ready,. you know, the data was gathered earlier, there's too much. I think it's too much.

I think that there's a great deal of pressure put on unfairly on some of the people. They didn't complain to me, but I just think that they are unfairly asked to analyze too quickly a significant crop report, and to come out with the supply and demand estimates the next day. That seems to me to be asking a lot of' an analyst. Maybe you don't agree with me on that, but I think that is true.

Mr. CORDARO. I would like to get Mr. Harkness' comments on what the effect of the long-term trade agreements might be on the grain industry.

In other words, would Cook Industries, Inc. or the other four or five major companies favor or oppose such an agreement!

Mr. HARKNESS. I'm not--I guess I'm not in a position to speak for the company on that. I'm not fully sure of management's feeling on that.

Mr. CORDARO. We appreciate that.

Mr. HARKNESS. All I could do would be to go back and to support Mel's comment earlier about the fact that how is an agreement of this type going to work, and the only time it works is when it's not needed, when it's totally not needed. If we've got scarce supplies how do we shut off if we can't ship 10 million tons? If they've got surplus supplies why how do they shut off not taking it in?

Mr. CORDARO. Could you comment on the analytical techniques that Cook Industries, Inc. and other grain companies utilize, such as the computer models for growing crops, and how you make use of weather and remote sensing information ?

Could you elaborate on how useful that is as an addition to the information that USDA supplies?

Mr. HARKNESS. Well, our techniques we mainly probably geared for timeliness. In other words, any time *a* number comes out from USDA, and let's say, *especially a* crop report comes out, that's a base, and at 3 o'clock in the afternoon when that report is released, at 3:01 p.m. no matter what our thinking was beforehand, our thinking is that, as of the first of the month, that's what it was.

And this is the attitude that we take on most Government statistics is that this is the base, but there's a timeliness here and it's a—so we . find techniques which will indicate ahead of time what something else is going to say. And one point I would like to make along this line is t e fact that I repeatedly hear out of FAS, Well, we haven't heard from the cable we've sent 2 weeks ago." If we want to know - something today we pick up the phone and we call. We don't wait to send a cable, and because these kinds of things you need to know now, and you don't need to know 2 and 3 weeks from now. And I don't know if this can work within the Government, that you pick up the phone and call, but by the same token this is one solution we have to the timeliness problem.

Mr. CORDARO. When the August 11 crop report comes out, you know that reflects the conditions as of August 1. By that time, you've already accounted for what's happened during those 10 days.

Mr. HARKNESS. Yes.

And we're continuous analyzing all the known components of what makes a crop report. We, with public knowledge, or things that are most public, are--our actual precipitation data and temperature data.

Mr. CORDARO. Do you think the Department could decrease this 10-day lag? You obviously do it.

Mr. HARKNESS. We do it, but I think that's our job to do. In other words, on the 10th of September when they come out with the report, no, I don't think they should be asked that that report be as of the 10th of September.

I don't think that it's their commission. Their commission is to come out September 1. Now, if some kind of a—I'm not necessarily advocating this, but if we within the United States need some kind of an update system, you still leave that report as of September 1, and Winebody in Government determines a way to update and try to shoot toward the next one, but I'm not advocating anything.

Mr. CORDARO. What kind of premium does Cook Industries, Inc. place on information? Is 1 percent of the total budget spent on re- . sources and techniques, or 5 percent?

Mr. HARKNESS. I am not sure. because I, as an information source of Cook Industries, have an unlimited budget. I mean, in other words, if there's a job to be done, I'm there. So I don't even known what my budget is as part of the total.

But I think to emphasize one point though of the priority that is put on, in mid-August I was standing in a cornfield in Iowa one day, and 48 hours later I was standing in one in France. We had a drought in Iowa and we had a drought in France, and they had to be assessed. It's just a matter of timeliness, because these things can't wait.

Mr. CORDARO. Thank you very much, Mr. Harkness.

Mr. HARKNESS. Yes.

Mr. CORDARO. Mr. Daddario do you have any questions?

Mr. DADDARIO. No. Thank you very much, gentlemen

Mr. CORDARO. Thank you very much.

As our nexi panel of witnesses, we have Mr. Frazier, Mr. Hamilton, and Mr. Johnson.

In the interest of time, please summarize your statements. What we're principally interested in here is finding out what the end user's prospective is. There's a great deal of information that the Department of Agriculture collects, analyzes, and disseminates. There's a good deal of information that comes out of the Congress. Congress is intrinsically dependent upon that information which comes from the executive branch . They are also intrinsically dependent upon information that come to them from the various farm groups and farmers. Congress in this case has asked OTA to make an assessment, to identify ways to improve its capacity to analyze this information and to make independent analyses of the validity of the information coming on a timely basis.

Could we begin with Mr. Johnson?

STATEMENT OF REUBEN JOHNSON, NATIONAL FARMERS UNION

Mr. JOHNSON. First let me commend very highly the colloquy that Senator Humphrey carried on with the representatives of the Department of Agriculture. Certainly the line of his questioning and discussion with the USDA witnesses demonstrated his deep understanding of the function of the whole bureaucracy and particularly the Department of Agriculture and its statistical gathering operations.

Let me also say that I appreciate deeply the pressure of time the Senator is under because I was at a hearing this morning regarding our grain inspection system which he chaired most effectively and is one of the important developments in the. testimony that I've heard in regard to the grain inspection system.

Second, I may shock a few people for making this statement-but we in the Farmers Union generally find the Department of Agriculture's statistical information and related resources to be highly useful to us.

As I reviewed the areas of concern in my organization I would make several comments in terms of some general areas that we follow quite closely in terms of agricultural reporting.

The first one of these I'd mention would be what we call the cost-price squeeze.

We are constantly reading the indicators on price levels and what movement they are taking. In this connection when we talk about cost-price squeeze, we relate directly to measurement provided by the parity formula. This formula is set forth in the basis agricultural statutes. Statutory law and I stress this point, relating to agriculture, and dating back to 1938.

The parity formula dating back to the 1938 Agricultural Act has been amended on several occasions-it's been modernized. It still functions, we think, to accurately portray how well farmers are doing—relating the prices they receive to the prices they pay in the calculation of the '(parity ratio," We are greatly dismayed by the fact that Secretary Butz never uses the term. He completely ignores it, and it is a tragedy that we have a Secretary of Agriculture who ignores a congressional mandate that sets forth the most realistic measurement that we could possibly have to reflect how well farmers are doing.

And I hope someday we'll get that situation turned around. '

The Department of Agriculture could devote more of its energy to reporting on the relationship between price that the farmers receive and the price that they pay, and they could do a much better job than they do of reporting on what that parity ratio is, which is calculated on the basis of movement of these indexes. That's the first area of our concern.

The second area I'd mention is the area of supply and demand. In . our Farmers Union News Service, we provide our States through a TWX operation, which is the Western Union Wire Service, information regarding supply-crop projected supplies. Hopefully, we're getting information to our editors in the country that they can use effec- . tively to give some guidance, at least, to members in terms of the "market forces relating to supply and demand.

The third area that I'd like to mention that we constantly are looking at, and need information with regard to, are the marketing margins. We do have a sincere interest in our organization in seeing that consumers get a fair break. We therefore need to have more information in terms of economic concentration in the processing and r&ailing establishments> and -just what marketing. margins mean in terms of the interest not only by farmers, but consumers also.

The fourth area that I'd like to refer to relates to the crop report'ing, crop and livestock reporting information of the Department. I know that there have been criticisms made of inaccuracies in the Departrnent, and vet I think when we really get down to it, we've got the best, system of livestock and crop reporting of any nation in the world. It "is a forecasting system, and you can't always come out right on target.

Incidentally, let me say I do support the views of those who indicated that there should be some attempt in the Government to resolve differences when they occur, just as they hammer out differences in the crop reporting board before they. make their forecast.

I believe that that kind of interaction—it may take time-but that kind of interaction would be useful in terms of getting the numbers that are more reliable. Where there are differences and there is some procedure here to resolve them, we're going to get more accurate projections. I'm glad to be here. That's all I've got to say.

We have a lot of concerns with Secretary Butz and his policies, but this is not the kind of hearing where we should air those concerns. You are here examining the informational processes, and I'm saying that they function well. There are obviously some areas that we would like to see stressed against others, and these I've mentioned.

I'd be happy to respond to your questions, I look forward to my two illustrious colleaques and their comments.

Mr. CORDARO. Thank you.

Why don't we go on to Mr. Frazier?

STATEMENT OF CHARLES L. FRAZIER, DIRECTOR, WASHINGTON STAFF, NATIONAL FARMERS ORGANIZATION

Mr. FRAZIER. Mr. Cordaro, I'd like to comment briefly on three areas of interest, and I should preface those remarks by pointing out that our commodity departments in Corning, Iowa, of course, have daily interest in the products of the various reports that you have under consideration.

From another standpoint we are interested in the effect of these various Government reports and projections on markets that seemingly at-times have nothing to do with the facts.

In other words, I believe there are two aspects of this whole area of concern that are very significant to farm people. Now, thinking of the facts I want to join others in expressing a sense of admiration for Dr. West, Mr. Hume, and Dr. Paarlberg, the men from the Department who must struggle with these things year in and year out. Those of us who have been close to that Department for a number of years know that it's most difficult to resolve variations in reports, reach compromises, and come to some conclusions for a public statement. We appreciate their difficulties.

In all of their fine work they may have difficulty today in assembling timely information on the consumer end of the market. In other words, I wonder whether they have an opportunity to get current data on consumer preferences, trends, and changes that will be reflected months or a year later in the type of government analysis that is always so safe to make on an after-the-fact basis.

One can well imagine that they may need if not new methods, at least some new access to data of this type. By the same token those of us working with legislation are all too well aware, as Mr. Johnson just pointed out, that the data available in the Department with respect to the cost of farm inputs may also be rather outdated by the time it can be worked into parity price reports, cost of production indexes and similar data that are rather important in the decision process, both in the Department and here in the Congress.

I have in mind things which relate more to the ability to gather and assemble this data in a timely manner. I rather suspect that their major sources are the industries, they may, be well worked out and quite honest in the final analysis, but it's a matter of timeliness and availability y of the data that is of concern to some of us.

In the second subject area, I do support the thoughts of Mr. Harkness and others that spoke of a world crop reporting board. I quite frankly am a little skeptical of what might be done in a formal board. The data, of course, would be only. as valuable as the capabilities and the honest-y of the people, assembling and submitting it for the various areas of the world. Nevertheless we do like the idea if it can be developed.

That one leads me to the third point, and this is even a little more difficult to express. I like to think of it this way: I wish we had in this (government perhaps at subcabinet level, the willingness to be a little more daring in the use of such statistics as are available.

In other words, all of us understand quite well that in each of these commodity areas in USDA, for example, there will he one, two. or three persons that are well recognized as specialists in their field. They know the overall picture with respect to a given commodity area, whether it be feed grains, or hogs, or cattle. oils. or what have you.

Now, I'm only asking that your group consider that the fine formal USDA reports that are made available to us generally under the three categories: Situation reports, crop reports, and supply and demand situations are outdated by the time they are released. I do not mean to suggest skullduggery or illicit action of any type but we must realize there are a few people who can afford the type of intelligence needed to make good market decisions. Most of them are the international trading corporations.

I don't think that it's necessary for a government officer to be absolutely safe in his backup data, and have all the charts perfectly drawn, to make a commodity statement reflecting estimates of market probabilities based on intelligence reports from attaches and others.

We have a number of people both in the trading world and in our farm organizations who must make their best guesses in sales and bargaining programs. Individual farmers must take whatever they may have and make decisions. They are sufficiently mature to understand very well that an projections representing crop conditions, markets or foreign demand in 15 or 20 countries scattered around the world is a speculative matter. They do not expect the Government officials to have it in the form of a final accounting report but they would like to be advised of what is available from time to time.

So I just want to make a little plea for some type of action that would draw together the intelligence not now available to farmers; I don't care if it's from the Department, CIA, the attaches, trade sources for that matter, if somebody is willing to get them in and pull them together, and willing to take a risk by putting out their best estimates of world demand and market conditions.

Mr. DADDARIO. You are really asking that there be a way to regularize the informal information that is brought together which some people are using to good advantage, but are using it for their specific interests.

Mr. FRAZIER. Yes, sir.

Mr. DADDARIO. It works quite well wherever it's worked, but if you try to regulate it, it might become so perfect it's not useful. Is that your point ?

Mr. FRAZIER. By the time it's a perfect figure you can see it's already too late. Well, I'm doing a poor job of articulating my point of view perhaps. I'm only asking for such intelligence as we have in this Government, from week to week, as month to month, relating to supply and demand situations be summarized and put out. Let the people have them, and let the little commodity division traders that must be working in cooperatives and in my organization understand them and argue about them. I think we'd all be better off-I think Congress, and for that matter, the Secretary of Agriculture, would be safeguarded against criticism at later dates if this data could be made available in more timely manner.

Mr. DADDARIO. Understood for that purpose?

Mr. FRAZIER. Yes, they can put at the top and bottom of every page that this is a projection—this is an estimate, and safeguard themselves carefully.

Mr. CORDARO. Mr. Johnson, Mr. Hamilton, would you care to comment on that?

STATEMENT OF W. E. HAMILTON, CHIEF ECONOMIST, AMERICAN FARM BUREAU FEDERATION

Mr. HAMILTON. Well, I would make the comment that since we have a supply and demand estimates report which is issued on a regular basis, after any new development such as a crop report, or a stocks report, tile situation is much better than it used to be.

I'm not quite as sure, as Mr. Frazier is, that the Department can escape criticism if they put out information hurriedly and make mistakes.

Mr. CORDARO. OK.

Mr. JOHNSON. May I make a comment there?

We are constantly making an interpretation of these USDA reports of our own, our crops, our big regional grain terminals, those in the Twin Cities, I'm sure have a battery of people who are constantly looking at the market forces that they have right before them all the time. We have a national secretary who has some competence in the area of analytical work—Robert G. Lewis-and Bob does an interpretive analysis once in a while in which he takes some issue with the USDA report based on information that he may have picked up.

Mr. FRAZIER. That gentleman sat right here and told us how and why he was able to make the projections.

Mr. JOHNSON. He said he was doing just exactly what you said the USDA should do. Further we have all kinds of reporting service letters around that do attempt to update, and bring more current data to farmers and the Department.

I'm not really arguing with the basic premise that we need to cut the time of USDA reporting. I think obviously there is room for improvement.

Mr. HAMILTON. We do need to cut the time from when a report is mentioned until it reaches the desk out in the country. Sometimes you get these reports in a day or two, and at other times it may be 2 weeks. Now, this may be partly due to delays in the printing office as was mentioned earlier or the postal service; but delivery is often slow.

Mr. DADDARIO. The point you just made is quite interesting. The reason I asked the question was that I thought there was a correlary relationship between what Milling and Baking News had to say and Mr. Frazier's suggestion—that somehow they can work through this process and come to certain conclusions which they did publish. But because for some reason it wasn't made generally available or understood, some people believed it, other people did not, and there were a lot of conflicting activities that went on during that period of time. If I understand Mr. Frazier's point to be that if you could somehow reglarize that so the people would know what it was and give it wide distribution, that more people might be accurate. Although you make the point that more people could be wrong too, more people might be right because they would develop an ability to deal with it as you went on.

It's something like reporting intelligence under very tight circumstances. The people who are the boldest and who develop the capability usually are much more right than others. People keep looking to them constantly for the information by which the corporate develop tactics and strategy.

Mr. FRAZIER. Yes.

Mr. JOHNSON. Now, every farmer himself is somewhat of an armchair forecaster. He goes out and wets his finger and puts it up in the wind, and he—

Mr. DADDARIO. And it's to those people Mr. Frazier is appealing, because they do have the capability, and they will be able to judge where it's right and where it's wrong.

Mr. JOHNSON. I think one of the things I agree with Chuck on, if I understood what he's saying, instead of having to wait, for the fancy type from the Government Printing Office, in a properly stapled, publication of some kind, we would do just as well with some mimeograph sheets.

Mr. FRAZIER. No, no, let me be sure I'm understood properly. I'm not saying, you know, run down with this crop report at 9 o'clock at night and pass it out on 14th Street-that's not the problem area I'm trying to address. The Government Printing Office has another problem, and I'm not worrying about that.

I'm worrying about the fact that attaches are constantly writing reports, and people in FAS have a certain feel in intelligence for what's shaping up 'in Western Europe, and there area number of individuals that know very well what's happening in the wheat crop in Australia and Canada. This year we've heard a lot of conversation about soybeans in Brazil and the statements that are made.. Impressions created about the Japanese interest in soybeans in Brazil depends "almost entirely on the speaker and his point of view.

My point is that material of that type along with our own crop reporting information and our own supply and demand type of work. could be well drawn together and someone could put his neck out a little bit and say, look, if these things happen, this is going toward a tighter supply and a higher or lower market price. and put it out.

Mr. DADDARIO. Mr. Johnson, maybe this will be helpful. I think this discussion is important because we run into in other areas as we do our work in asessments. It's an additional step that is a preceding step. Rather than to eliminate that as you go to a final step. You have to take that step anyway, don't you?

Mr. FRAZIER. ,That's right.

Mr. JOHNSON. That's providing, I would say, more flexibility in terms of the reporting procedure.

Mr. DADDARIO. And because you proceed further you can judge how you've done.

Mr. JOHNSON. That's right. And I think Chuck made this point very well, but it has to be kept in mind that this type of information when it's put out by a Government agency, it has to be done in such a way that everybody has an even start, and that this information becomes public information. It should be known when it's going to be released. The press should stand behind that "white line" and every one over at the Department of Agriculture when those crop estimates are made. Currently, the reporters stand behind the white line, and at 3 o'clock some USDA staffer hands them a piece of paper and they walk across the white line to a telephone. Now, that procedure is sound and it gives everybody an even chance to take advantage of the intelligence if you want to call it that, the information that's available.

Mr. HAMILTON. Well, I think the Department of Agriculture basically does as Mr. Frazier suggested, but perhaps they don't do it to the degree that he would like. They publish estimates, they publish projections, and they change the terminology as the basis for these figures becomes more firm, and they do frequently put out new reports. We have had several reports this year on the Russian wheat crop, but there was some confusion due to the fact that there apparently were reports from other agencies which were substantially lower than the USDA'S estimate.

Mr. JOHNSON. I might say that I'm happy to be able to report here that the Department of Agriculture is more accurate than the Central Intelligence Agency. That gives me hope in the future. ,

Mr. CORDARO. Mr. Hamilton, I noticed that in your statement, you commented on the recommendations, findings, and conclusions of our Food Advisory Committee's report.

We would appreciate it if you would summarize your comments for us now.

Mr. HAMILTON. Well, Mr. Cordaro, I realize it's late, and I don't want to take unnecessary time, but if you wish, I can summarize my statement, or if you prefer, I will submit to questions on the basis of your having read the statement.

Mr. CORDARO. Well, could you just give us a minute or two so that other people have some information ?

Mr. HAMILTON. Well, to give the others the flavor of my statement, I would like to say that I did not receive -your report until late yesterday evening, so I've had only a limited opportunity to study it, and even less time to confer with my associates in the Farm Bureau and like the Government, the Farm Bureau does have a clearance procedure. As a consequence my statement is a rather preliminary reaction from the standpoint of a person who uses Government statistics, but who does not profess to be an expert. With some reservations I think that most of the recommendations developed by the Food Advisory Committee are acceptable to me.

I would. however. like to stress the complexity of the subject, and the difficulty of satisfying the people who want better agriculture data. The very nature of agriculture makes it difficult and costly to collect reliable data, and this, of course, is much more difficult in less developed countries.

host agriculture statistics are estimates, and you have to recognize that all estimates are subject, to a margin of error. but the big problem is that the factors affecting these estimates constantly change. We've already had some discussion of his problem.

A report, can be quickly outdated by developments subsequent to the date on which the survey was made, and I agree with Quentin West, that certain types of forecasts. for example. a forecast on the pig crop may cause farmers to reassess their plans. The very fact that the report was made. ma-y prevent, the estimate from being right, because it stimulates adjustments and that's one of the functions of these reports.

On the whole I think the Department of Agriculture and its statistical agencies do an excellent job. We're all aware that they make errors, but given the difficulty of the job some errors are to be expected. And while I'm certainly in favor of improvements, I think the Department's batting average is very good, and I'm also impressed with the fact that a bad estimate attracts a great deal more attention than dozens of good ones. I never hear anyone say anything about the fact that a forecast was right, but I hear a lot about the ones that were wrong.

In evaluating proposals for improvements we have to consider the difficulty of the job. what is possible and the relationship of probable costs to the probable benefits. I believe this is known as cost effectiveness.

And then we should always remember, as has already been noted in a little different context, that any projection or analysis which can be outdated by unforeseen events may fall to be a prediction of the future.

I think this is pretty well illustrated by what happened in 1972. Many of the events which combined to make the sales to the Soviet Union look like a bad deal for the United States happened not only after the grain was sold, but over a period of months. I have cited some of these developments here, and if I had had more time to research the timing of other events that I'm familiar with, I would have included them. There was an extremely extraordinary combination of events following the 1972 Russian sales which combined to tighten supplies and raise commodity prices.

And I don't think it should be surprising that in the words of the Advisory Committee, "The economic models and supply and demand equations which had performed satisfactorily in the more stable conditions of the fifties and sixties had little value in light of the changes which occurred in the domestic and world markets when the size of the 1972 world grain crop became known."

I'm not familiar with these models and equations, but I am sure that they almost certainly reflect observations based on periods during which exporting countries had large surpluses; exchange rates for major currencies were more or less fixed; and some of the large potential importers, including the Soviet Union and the PRC, were more likely to tighten their belts than to buy large quantities of grain in the world market.

Now, I come to the recommendations in the Food Advisory Committee's report. The idea of increasing the analytical capability of the staffs. of the Congressional Committees on Agriculture and the Congressional Research Service has obvious merit. Certainly you need capable staff members to serve the Members of Congress.

It seems to me, however, that this increase in analytical capabilities should be used primarily to analyze information produced by research and statistical agencies such as the ERS and the land grant universities rather than to do original research. Regardless of the quality of the research that might be done on the Hill, it would be hard for a political body such as the Congress to avoid suspicion that at least some of its researchers were selected for their opinions rather than their analytical capabilities.

I would like to say that I favor Recommendation No. 2 which calls for Congress to develop closer liaison with executive agencies and the land grant universities.

I also support Recommendation No. 3 which calls for the Secretary of Agriculture to establish a Statistical Review Committee, and 1 would add that this committee should include some representation from farm organizations.

I have a little section that deals with the desirability and the feasibility of integrating the staff and activities of the Agricultural Census into the Statistical Reporting Service. Certainly this should be explored, and coordination improved. I think, however, there are some questions that need to be asked.

For example, I would raise a question with regard to the effect the separation of the Census of Agriculture from the Census Bureau might have on the coordination of agricultural data with other national statistical series produced by the Department of Commerce. And I would raise a question as to whether the burden of producing detailed county statistical reports would impair the ability of SRS to reduce high quality national estimates on a timely basis. County data can tie up a computer and this is one of the reasons, as I understand it, that the publication of data was so slow after the 1969 census. It was a problem of getting time on the computer and the sheer mass of data that had to be produced.

Improvement of the information collection capability of the FAS certainly is a desirable objective, but we shouldn't expect too much of our agricultural attaches. We should expect attaches to be well qualified observers, but we should recognize that no individual or small group of people can provide complete statistical reports from a foreign country of any size on the basis of personal observations.

The attaches necessarily depend on host governments for much of their information. The improvement of information on foreign agriculture is highly dependent on the improvement of foreign agricultural information systems, and increased 'international cooperation.

I certainly would not favor the suggestion that attache reports be sent, directly to FAO at the same time they are sent to Washington. I absolve the Food Adivisory Committee from having made this suggestion but it was in some of the papers that I read in preparing my statement.

My objection is that I feel such a procedure could lead to serious problems between the attaches and their host governments, and it might cause attaches to be less forthright than they otherwise would be. I think they can feel some security in reporting to--Washington but not in reporting to FAO. I am afraid the reports would be channeled back to the host governments and this could cause problems.

I agree that responsibility for statistical and analytical work should be kept separate from responsibility for operating programs. And 1 agree with the statement made by a previous witness that chairmanship of the interagency commodity estimate committees should be provided by the agency that has the responsibility for the estimates and assessments of the situation and outlook," rather than by an operating agency.

Since the Food and Nutrition Service is an operating agency, I question the portion of recommendation No. 8 which recommends that this service expand its program evaluation studies.

I am not sure that the improvement of agricultural information requires a consolidation of the economic intelligence activities of FAS and ERS. As the gentleman from the Department said, they do work together now. Consolidation may be a good idea; but with the limited knowledge I have I do not want to tell the Secretary how to run the Agriculture Department this afternoon. I do agree that FAS and ERS should be coordinated and that they should work together, and I think they do now.

I would agree that some agricultural data series are obsolete. This is well illustrated by the Food Advisory Committee's discussion of broiler prices. Broilers are not priced at the farm level in the sense that this series reports. The Farm Bureau has long been aware of this particular problem, and has recommended that USDA initiate a series of reports on contract payments to broiler growers.

I think Dr. Paarlberg said that they also need to review some of the concepts in the farm income series. I could go on and on, but time is short.

Thank you very much.

Mr. CORDARO. Thank you, Mr. Hamilton.

Dr. Wilcox, do you have any questions?

I should say that Senator Humphrey is always reminding us that Dr. Wilcox could probably. forget in 15 minutes more than we young staff people will ever learn in agriculture. OTA has a high respect and regard for Dr. Wilcox and we appreciate the help that he's given us in the preparation of the hearings and our assessment report.

Mr. HAMILTON. I'd like to report that I have known Dr. Wilcox since I was a student at Iowa State back in the early 1930's and Dr. Wilcox was a very young professor there. He was one of my first economics professors. I don't know whether he accepts any responsibility for my views, but I have been associated with him for a long time.

Mr. JOHNSON. Let me say that I don't guess I'm as old as Gene Hamilton because I was in school-Gene, you say you were in school when ?

Mr. HAMILTON. Early 1930's.

hr. JOHNSON. Gene, I thought you were younger than I am. I have known Dr. Wilcox since I've been in Washington with the Farmer's Union. I guess that's 21 years, and one of the things I learned even before I was dry behind the ears, about 20 years ago, if you wanted to get anything done on the Capitol Hill you first had to get Walter's signature on a letter with-"Library of Congress" written across the top of it. He's been very helpful to me on many occasions.

He never would compromise his stubborn objective streak, however. He always was honest and objective and Walter we are very happy to know that you're associated with this group.

Dr. WILCOX. I didn't realize. that Gene had been a student of mine.

Mr. JOHNSON. He's kind of giving-your age away, isn't he?

Dr. WILcox. Yes. They know it around here.

Having listened to you and other witnesses. and thinking of the conversations I had with other people, it seems that due to the current world food situation and recent supply problems. much more attention has been given to putting out reports on various items. USDA publishes statistics about so many supply and demand situations. We have quarterly situation outlook reports on wheat at one time and feed grains at another time. Perhaps what would be more useful is a monthly report on the world agriculture situation and outlook. Then the other reports would relate to it in some organized way. This would assure better organization among the various reports and place more emphasis on the senior staff preparing the monthly reports that contain the very latest information.

The SRS has a very regularized procedure for getting out reports. The trade knows it and the trade depends on it. Maybe that's what we need to go through in the rest of our economic intelligence reporting. That's what I've been hearing from various people. We're really producing too many numbers now, and not enough analysis.

Mr. FRAZIER. I think you have expressed very well another side of that many sided little thing I was trying to deal with a moment ago. There's a need for appraisal, a wrapup believe the newsmen would call it, the need to draw together some of these things. Quite frankly, our business people do not have time to do this, and organozations large enough to have a whole staff devoted to economic analysis and projections, they have got a regular means of absorbing and using this material. There are a lot of highly involved individuals and an awful lot of money committed out therein the count by people who do not have access to that type of information, and they need some form of drawing this together. I think that is what I'm trying to plead for.

Mr. HAMILTON. I think that it's less true today that it was 3 years ago. What Walter says was certainly true 3 yearn ago. These reports were published on a regular schedule and some of them were not very frequent. A crop report would be issued, and major changes made in tile estimate of production, or major changes would occur in export demands, and it might be 2 or 3 months before a situation report would come out with revised supply-and-demand estixnates.

In the meantime different people made their own estimates. Now, that situation has been improved, by the supply-demand estimates which are issued promptly after major changes in basic information. I think this new publication is intended to do a art of what has been suggested here. Now, it may not do it adequately; it's experimental, at least we haven't had it very long, but I think it is something to work on. I also think that the Department realizes that the old type situation reports were not doing the job. To take a horrible example, I think the Sugar Situation was only issued once a year, and trying to get anything current on sugar is still difficult.

Mr. JOHNSON. I have another one in this connection. Walter, you mentioned the release procedures over there. and it seems that you get more press coverage of the crop board information that's released across that white line at 3 o'clock on August 11, or whenever, than you do if you just get a regular commodity situation report mailed out once every so often.

And we turn our heads more to those types of situations where the Department releases data. Is it because we have more confidence in it, or is it because of the procedure where ever body meets each other there at the white line? I don't really know. Maybe there's an element of both involved, but anyway I think we could dramatize the importance of numbers that would get the press involved.

We need the media. I might add we get out all the economic data we can through several avenues in the Farmers Union, including our Washington Newsletter, but certainly we need the media too. We need a wide use of the information coming out of the Department by the people, and any way you could attract the media to use that information as a part of the educational process I think we ought to examine. Senator Humphrey mentioned that earlier today.

Mr. DADDARIO. **Walter, you are saying something here that could be very important. It strikes me that what you're saying is not just a way to get better information out in *a*** timely manner, but that conditions have changed so that the structure through which you get the information perhaps ought to be adjusted in order to meet these changed circumstances.

Dr. WILCOX. Yes. It has been indicated that the structure of the Government was set up at an earlier date and hasn't changed as much as it should have. We need this board to review world data just as we review other data. The witnesses today said it is done in an informal may. As long as it's informal and no one is responsible for it, it's not as valuable as one board with responsibility for the U.S. and world situation. World information is as important as domestic information, and it ought to be given a higher priority.

Mr. HAMILTON. We are on the world market now to a greater extent than in any other period with which I am familiar. I just haven't studied the 19th century, but you are right, world information is becoming increasingly important because we are in a world market to an extent that we haven't been in the past.

Mr. DE SIMONE. There% a very interesting graph in this issue of the Agricultural 'Outlook which dramatizes that. Mr. Hamilton, this perhaps can be made part of the record. It shows the share of exports of major U.S. crops; that is, the. percentage of U.S. production that becomes export'$. It's really startling for me as a layman to see that we had exported most of "our wheat and most of our rice. This is terribly important to the economy. Producers and consumers should be aware of this information

Mr. JOHNSN. .I might say that I have great difficulty interpreting the USDA reporting currently of the exports. I have not mastered tile system and the procedures used by the Department. I also feel that the time lag too creates quite a problem, and there's just got to be some better way to do it.

Mr. HAMILTON. Well, I would like to comment that the reports on export sales are in a sense raw, unevaluated data. I don't pay too much attention to them. I have a lot more confidence in the USDA's estimates which use these reports as raw material and I like to have the USDA tell me what their experts in the Department think is going to happen.

In an earlier day this type of raw data would not have been published, and would only have been made available to USDA for evaluation. I recognize in the present situation people are going to insist that the export sales report be published and it's probably useful to some people who are in the trade.

My feeling is that for the average user, the Department's estimates are more valuable, more reliable, and the Department does publish its own estimates, in a column adjacent to the undelivered export sales. So we have the information both ways, and you can use it any way you want to.

Mr. CORDARO. Unless Mr. Daddario, Mr. De Simone or Dr. Wilcox has anything to ask, I'd like to thank you. I would also like to add the Office of Technology Assessment is just now starting to get our food activities going . You can rest assured that we will be calling on you more frequently and asking you to assist us in our activities.

Thank you very much.

Mr. FRAZIER. Thank you.

Mr. JOHNSON. Thank you.

Mr. HAMILTON. Thank you, sir.

[The following letter was received from Mr. Frazier:]

NATIONAL FARMERS ORGANIZATION,
Washington, D, C., September 29, 1975.

Hon. HUBERT H. HUMPHREY,
U.S. *Senate,*
Washington, D.C.

DEAR SENATOR HUMPHREY: We appreciate very much your invitation to participate in the panel with other representatives of farm organizations to comment on the handling of data in public reporting by the Department of Agriculture as such work relates to food and nutrition.

First, let me compliment you on undertaking this challenging assignment. Despite the controversies that have developed over food supplies and prices in the last three years and the vicissitudes related to the political handling of some of these issues, there are many very capable people in USDA who provide a wide range of commendable services. I am confident that they are able to keep the country better informed and possibly reduce the public confusion and the controversy surrounding this whole subject area.

My suggestions touch on three matters of concern:

TIMELY DATA

It is quite possible that responsible administrators do not now have access to timely information on consumer food preferences and developing *trends* in the public's purchasing habits. Some type of continuing survey that would supply appropriate data on a weekly or monthly basis could be very helpful.

By the same token, those of us in farming who have faced rapidly rising costs of production since 1972 often believe that the costs of farm input items incorporated in the USDA reporting system are out-of-date when they are used. Without going into great detail, I believe it is fair to assume that a substantial part of this data comes from industry sources. If these sources are not biased, they are at least reluctant to disclose the bad news to the government. Again, if resources were so arranged that USDA personnel could be well advised on prices actually paid by farm and ranch operators, the judgments to be made both in the executive branch and in legislative considerations might more accurately reflect the actual farm situation.

WORLD CROP REPORTING

Mr. Harkness' recommendation for a world crop reporting board is constructive. Although we have some reservations about the possibility of requiring or eliciting responsible estimates from the representatives of sovereign nations, the prospects of coordinating such crop reporting efforts with estimates of quantities to be moved annually in foreign trade are of such significance that an effort along this line should be made.

One note of caution is offered for your consideration. If one should undertake to follow the broad suggestions under Food Assessments in the annual report of OTS and also to implement the recommendations outlined in the report of the Food Advisory Committee, substantial resources would be committed and it is possible that the rewards would not be commensurate with the increased cash outlays for such widespread efforts. It is suggested that a small number of individuals who are capable of the task be asked to establish priorities that would more clearly promise a payoff in the form of better data and more intelligent decisions relating to our national policy on food and agriculture.

COORDINATION AND RELEASE OF ESTIMATES

It should be emphasized that there are many individuals in positions of responsibility in our organization as well as a number of well-educated farmers and ranchers, who must make crop decisions at various times in the year relating to financial commitments on production items, determine when to sell and estimate what price they may expect on their commodities after harvest. Under the current structure, international organizations, institutional economists and a few of those on the Government payroll who are concerned with these data may have time to comb through Situation Reports, Crop Reports, the supply and demand estimates and the press release type of statements made occasionally at the cabinet officer level. Most of us, however, do not have the time or the capability to adequately predict what will happen both in market prices and production item costs.

The problem is further complicated by the fact that a large proportion of our crops now move in international trade. In most nations of the world this trading is supervise? and handled or otherwise controlled by the central government. I think it is a fair analysis to assume that international traders with contacts in those governments and our own government representatives are the only ones who are equipped to be well informed in a timely manner.

So the suggestion is this—that the Executive Branch assume the responsibility, perhaps at subcabinet level, to produce summary reviews and speculative comments on new crop prospects, purchasing intentions -and the political pressures involved in other countries. This type of issuance on a particular commodity would make available to the public the 'best guess' on markets and prices based on information gained through intelligence sources and other information-gathering services available only through the government. *This* type of opinion is occasionally reflected now in very 'brief press release statements forthcoming from the Secretary of Agriculture, but such statements generally relate only to small isolated events, such as a possible purchase by one or another nation, one which constitutes only a portion of our total market.

What I have in mind would be entirely separate from the regular crop reports or other types of estimates that are issued periodically. Those are published with supporting tables of data to allow for discussion in the normal bureaucratic manner.

The only people capable of offering the opinions or projections on a speculative basis such as I suggest, other than the personnel in a few large international corporations, are in government. They could be of real service by sharing their best guesses with the rest of us. Of course, those of us outside government would have to realize that these estimated projections of demand and price on major commodities would be highly speculative; we would have to be will.lng to accept them at face value without any guarantees of certitude. Even under those circumstances, however, we would have more information upon which to base our operating decisions.

It is hoped that these comments will be helpful to you and your staff. If we may be helpful In the future, please don't hesitate to call on us.

With best regards,

Sincerely,

CHARLES L. FRAZIER,
Director, Washington Staff.

[Whereupon, at 5:25 p.m., the meeting was adjourned, to reconvene December 10,1975, at 9:30 a.m.]

FOOD INFORMATION SYSTEMS

WEDNESDAY, DECEMBER 10, 1975

CONGRESS OF THE UNITED STATES,
TECHNOLOGY ASSESSMENT BOARD,
OFFICE OF TECHNOLOGY ASSESSMENT,
Washington, D.C..

The Technology Assessment Board met at 9:30 a.m., pursuant to notice, in room 6202, Dirksen Senate Office Building, Hon. Hubert H. Humphrey (member, Technology Assessment Board) presiding.

Present: Senator Humphrey and Congressman Brown

Staff present: Mr. Emilio Q. Daddario, director; Mr. Daniel V. De Simone., deputy director; Mr. J. B. Cordaro, food program manager; Dr. Walter W. Wilcox, consultant; Ms. Ellen Terpstra, research associate; Ms. Ann Woodbridge, administrative assistant. ,

Mr. BROWN. The bearings will come to order. The purpose of these hearings is to discuss the information requirements for a national food policy. Senator Humphrey has been detained, but I would like to insert his opening statement into the record at this time.

STATEMENT OF HON. HUBERT H. HUMPHREY, A U.S. SENATOR FROM THE STATE 0F MINNESOTA

Chairman HUMPHREY. Today is the third day of hearings that I have chaired for Congress' Office of Technology Assessment. Before we begin today's dialog with our distinguished panel of experts. I would like to review the purpose of these hearings and share some of our earlier findings.

In 1974 I requested, with the endorsement of Chairman Talmadge of the Senate Committee on Agriculture and Forestry, that the OTA make an assessment of food information systems and their adequacy for policy planning. The combination of world events that occurred in 1972, 1973, and since, have underscored the necessity for this assessment. These events have been well chronicled, and their consequences and effects are still being felt today; and the recently revised Soviet harvests-down from 215 million metric tons to 137 million: metric tons—further support this critical need.

Increased attention has been given to the importance of agricultural information:

In 1972 Senator Bellmen and I visited the Soviet Union. Our report, "Observations on Soviet and Polish Agriculture;' recommended among other things increasing the number of agricultural attaches assigned to the Soviet Union.

The 1974 World Food Conference recognized the vital role of adequate, timely, and objective information. I wrote to the U.S. Food Conference Coordinator urging that our delegation support the establishment of a World Food and Agricultural Information System. I was pleased that the U.S. delegation did give strong support to my request. The Conference adopted a resolution calling for the establishment of a worldwide "Global Information and Early Warning System."

Numerous other reports and experts have brought to the public's attention the urgency of correcting the deficiencies that exist in U.S. and worldwide information systems.

Today's hearings are especially timely. We no longer know from da to day what the next food policy pronouncement will be or who will make it. The capricious food policy decisions and statements of Government officials in the past 6 months have seriously affected farm prices, created uncertainties in the markets, and demonstrated to Congress that anew and stable food policy structure is urgently needed.

As long as apparently limitless reserves were available, there seemed little need to gather exact information on the world food situation. Emergencies could always be met. However, that is no longer the case, since administration policy has allowed food reserves to dwindle from a 90-day supply to less than a month.

This hearing will explore proposals for a more pragmatic, more consciously planned approach to developing and implementing a national food policy. OTA's Board will weigh and balance these differing appreaches in order to frame options for congressional consideration.

We need a national food policy. We need to make significant changes in our food, agriculture, and nutrition programs and policymaking process.

As one of our experts today will state, a comprehensive and consciously coordinated national food policy should be framed in terms of a body of broad general objectives which would:

(1) Provide adequate supply and reasonable price stability to consumers;

(2) Assure fair returns to farmers;

(3) Provide assured supply for a continuing high level of commercial exports;

(4) Provide an available supply for feeding programs or disaster relief at home or abroad;

(5) Enable the United States to fulfill its international commitments and attain its objectives in food matters;

(6) Improve nutrition at home and abroad.

These six goals are well reflected in the two most significant elements that must be addressed within the framework of a national food policy, which are: (1) the need for the United States to improve its resource production and management activities and policies; and (2) the need for the United States to be equally concerned with the postproduction elements of the food system, especially those which affect nutritional status and health of consumers.

A national food policy created to meet these objectives is not only possible and desirable but essential. The United States must utilize its food production capability to maximize the economic, political, and social benefits. Only an organized, coordinated, and well-integrated national food policy can accomplish this. To state the goals and the need is the easy part.

The difficult part is to design or fit the elements into a systems concept and the development of programs within each component. I have asked OTA to accept the responsibility in this task They will explore tile total food system from the viewpoint of (1) production, (2) marketing and processing, (3) retail distribution, and (4) consumption and nutrition.

Only through adequate planning and careful coordination of national food policies, in the light of systematic and timely information on the current food situation, can the world improve its present condition.

We must reduce the realm of the unpredictable and eliminate somo of the guesswork in agricultural policymaking . Only in this way can we provide a sound basis for developing world food security.

Information is a precious commodity. To be useful, it must be objective, timely, and reliable. Such information will not automatically insure the right decisions, but it will improve the tools available to decisionmakers.

The report submitted to the Office of Technology Assessment by OTA's Food Advisory Committee in June made 12 recommendations to improve food information systems. Today's hearings are designed to expand the content of these recommendations and explore ways in which these options might be implemented by the Congress.

OTA's Food Advisory Committee will hold a further session which is scheduled for January 15, 1976.

Because Congress needs to obtain outside information u on which to base its decisions, it was necessary to focus on some of the main sources of information and especially the U.S. Department of Agriculture.

We also had, at our earlier hearing, the opportunity to hear from representatives of the farm organizations and the private grain trade and review the food and agricultural organization's plans for an expanded global information and early warning system. These materials will be used in the preparation of OTA's final report to Congress.

Today's hearings provide an opportunity to go one step further, to consider the informational requirements for a national food policy.

I am pleased to have with us such a distinguished panel of experts. Each individual has a prepared statement, but in the interest of time, he will present a short summary, with the full statement made a part of the record.

Present with us today are:

Willard Cochrane, professor of agricultural economics at the University of Minnesota;

Lauren Seth, chairman of the Agriculture Committee of the National Planning Association;

Luther Tweeten, professor of agricultural economics at Oklahoma State University; and

E. A. Jaenke, of the agricultural consulting firm, E. A. Jaenke & Associates.

Mr. Brown. Our first witness this morning will be Mr. Ed Jaenke of E. A. Jaenke&Associates.

STATEMENT OF ED A. JAENKE, PRESIDENT, E. A. JAENKE & ASSOCIATES, INC.

Recent developments have increased the complexity and importance of U.S. and world food problems. The conflicting responses and approaches of the man interests involved have made clear the need for a national food policy, a Government structure to effectively coordinate its implementation, and the need for improvements in the U.S. and international food and agricultural information systems.

This report, prepared for the Office of Technology Assessment of the U.S. Congress, assesses alternative governmental structures and their informational requirements for the United States to formulate and administer a national food policy designed to cope with uncertain supply/demand situations likely to occur in the decade ahead.

This report has been prepared by the consulting firm of E. A. Jaenke & Associates, Inc. Major contributors have been Quentin Bates, Malcolm Maclay, and E. A. Jaenke.

The report is divided into four major sections. The first traces the supply/demand situation for food and identifies the economic, political. social, and informational factors that have contributed to changes in the overall food situation. It summarizes the current information and the most comprehensive projections as to world food developments in the medium-term future.

The second section assesses current agriculture policy, its legislative authorities, and administration and presents goals and guidelines for a national food' policy.

The third section presents a survey and assessment of present institutions.

The fourth section offers three alternative governmental structures, the advantages and disadvantages, and the informational requirements of each.

I. WORLD'S FOOD SUPPLY-PAST, PRESENT, AND PROJECTTONS

ROOTS OF THE RECENT FOOD CRISIS

Complacency and overconfidence.—The food crisis of the past few years erupted suddenly and unexpectedly on a world that had become complacent about its chronic food problem. True, some 400 million people were chronically malnourished, but the developed countries salved their consciences and helped alleviate suffering by large food aid programs made possible by surplus grain production.

In spite of food aid programs and production restrictions during and slightly beyond the 1960's, grain reserves in the major producing countries remained uncomfortably high and easily absorbed the leap in import demand created by the U.S.S.R, and Asian droughts of 1965 and 1967. Grain prices had been relatively stable for two decades and real prices had actually declined rather significantly. Considerable confidence was felt that the potential for production expansion in the developed countries, combined with the "Green Revolution" in the developing economies, would easily match the growth of effective demand for the foreseeable future. With what are now recognized as low fuel and fertilizer prices and a steady rise in productivity, grain prices were **expected to** remain stable at relatively low levels.

In 1972, a bewildered world suddenly found itself entering into an extremely unstable food situation, with supplies temporarily tight and prices gyrating wildly.

The ostensible reasons for this abrupt change in direction are well known; that is, abnormally poor crops in several key. areas—a shift in the Humboldt Current-unexpectedly large Soviet, imports--widespread inflation-us. dollar devaluation-to cite only the most important. However, with the benefit of hindsight, we can now ***clearly see*** that this crisis had its roots in largely unnoticed developments ***in*** *grain* supply and demand during the years of apparent stability.

Demand pressures **build.**—Social, economic, and political factors contributed over a period of years to a strong upward pressure on effective demand for food in the early 1970's. Food consumption in the developing countries was rising faster than their food production, resulting in growing dependence on imports from the developed countries. However, grain production in the developed countries was rising faster than consumption. Consequently, a major concern during the 1950's and 1960's had been the management of surpluses. This concern led to large food aid programs and to tighter grain production controls which by the late 1960's had substantially reduced the large reserves that had traditionally given stability at low price levels to the world grain markets.

Meanwhile, several centrally planned economies which had 'been traditional net grain exporters were steadily moving toward an import deficit position.

Reinforcing the upward pressure of rising population and income on demand was a marked shift, both in official government policies and in public attitudes. toward a greater awareness of and sympathy for the problems of hunger and malnutrition in the world. This shift in approach has been developing on both international and national levels. The following are a few recent examples:

The World Food Conference in November 1974 effectively focused international attention on food problems, and a climate of unexpected cooperation surrounds the followup activities.

The International Bank for Reconstruction and Development and other U.N. agencies are presently devoting much greater resources to food and agricultural development than previously.

Bilateral aid programs are giving top priority to agricultural development.

While food aid appears to have been cut back from earlier -years. especially by the United States. because food aid programs are now more nearly divorced from surplus disposal, multilateral food aid for purely humanitarian purposes is probably at an alltime high.

It is with individual nations, however, that this shift in policies and attitudes is probably most significant and least recognized. Inmost (Developing countries. hunger and malnutrition were endemic and were often viewed fatalistically as insoluble problems. Surplus food producing countries and developed countries often were either genuinely unaware of their own hunger problems or unwilling to admit them publicly. The general public in the 'United States reacted with a combinat ion of shock, anger, and disbelief a few years ago when a Senate investigation revealed the extent and seriousness of hunger in this country. This played no small part in the relatively unpublicized but truly astonishing growth in recent years of our domestic Federal food assistance programs from about $1 billion in fiscal year 1969 to an estimated $9 billion in fiscal year 1976. In addition, substantially liberalized welfare programs have steadily boosted nutrition levels for the needy.

This development is less apparent among many other developed countries mainly 'because most of them, particularly in Western Europe, have long had liberal social programs. The centrally planned economies, however, are showing greatly increased concern for improving and upgrading the diets of their peoples, whose incomes are rising and who are insistently demanding more livestock products and greater variety. The OPEC countries are devoting an important share of their "instant riches" to food imports and agricultural development.

Many developing countries as well are making greater efforts to provide more adequate food supplies. Last season when her crops were small, India imported about 6 million tons of grain-she reportedly plans to import about the same quantity this season even though her grain harvest this year is excellent. Indonesia, South Korea, and Bangladesh are among other LCD's that are straining to step Up food imports.

By 1972, the world had become highly vulnerable to even a moderate reduction below trend in food supply. Developing countries had a large and growing dependence on imports because their own production, which had been inhibited by low prices and reliance on food aid, had not kept pace with demand. The centrally managed economies were subsidizing food consumption and were also unable to increase production sufficiently to satisfy their people% insistent demands for upgraded diets. In the developed countries, demand for livestock products had turned sharply upward, lifting feed grain requirements with it. Rising export demand and production controls had reduced reserve stocks in the surplus producing countries to levels that were only about 50 million metric tons over pipeline requirements. This compares to the normal annual increase in world consumption of about 25 million to 30 million metric tons.

Nevertheless, at the beginning of 1972, the world's grain producers, particularly those in the United States, were still very worried about grain surpluses. In the United States, carryover stocks had increased by 18 million tons over those of the previous year. Although the U.S. export outlook was good, partly due to the devaluation of the U.S. dollar, the size of these grain stocks kept prices at low levels, and both farmers and the administration were eager to expand exports even more.

From surplus to *8hortage in* 1972.—The drought that struck the U. S. S.R., Argentina, Australia, and South Asia did not reduce world grain production by more than 2 1/2 percent from that of the previous year, but consumption jumped by 35 million metric tons, exports by 15 million metric tons, and carryover reserve stocks fell by about 30 million metric tons.

The principal swing factor in this picture was the Soviet decision to make up its entire shortfall in grain supplies with imports. In 1963, 1965, and 1967, Russian grain production had fallen substantially below the previous year--and also below trend—-by an average of about 30 million metric tons. Yet in each of those years, *the* Soviets pulled in their belts, drew down stocks, slaughtered some livestock, and made do with imports of 10 million metric tons in 1963-64, the year they were worst hit; 9 million metric tons in 1965-66; and only 1 million metric tons in 1967-68. The change in import policy in 1972 seemed astonishing at the time, but we now know that the Soviets felt they must make good on their commitment in the 1971-75 5-year plan to increase livestock production by 25 percent. They therefore imported 22 million metric tons of grain in 1972-73 when their production had dropped only 13 million metric tons from the previous year—net imports were 19 million metric tons, as compared to the 197l-72 net of 1.4 million metric tons. This policy is obviously still in effect as the massive Soviet purchases of this year bear witness.

The Soviets would not have been able to buy up such a substantial portion of the world% grain reserves in 1972-73 at low prices had it not been for the failure of our intelligence systems to furnish adequate and timely information on Soviet crop prospects and 'buying intentions. In addition, the lack of coordination and exchange of information between various Government agencies and departments handicapped effective action by the appropriate U.S. officials.

Without pointing the finger of blame at anyone since the Soviets went to great lengths to conceal this information, we wish to point up this excellent example of the importance of establishing more effective and better coordinated information systems.

The story of developments in the world grain situation since 1972 is well known. Prices have fluctuated violently but from a much higher base. Stocks dropped precipitously and carryover stocks have been at little better than pipeline requirements since that time. World crops were good in 1973. but, below trend in 1974 and again in 1975, when record crops in the United States were counterbalanced by a near crop failure in the U.S.S.R. In the United States, the administration yielded to consumer pressure and embargoed or restricted exports on three occasions-on soybeans in 1973, on corn to the U.S.S.R. in 1974. and on all oilseeds and grains to the U.S.S.R. and to Poland in 1975. These steps were violently opposed by U.S. farmers, who had been requested to go all out for production. Hindsight has demonstrated that none of the actions had really been necessary.

PROJECTIONS—THE NEXT 10 YEARS

The world outlook.—The sudden shift from abundance to scarcity in world grain supplies has revived echoes of Malthus in the current rash of predictions that we have finally reached the limits of our ability to increase food production sufficiently to match population growth. One school takes the somber view that we are on the verge of widespread and growing famine conditions in which the per capita supply of food will progressively decline. Others feel that we can provide adequate food supplies only if the affluent reduce their consumption of grain-fed livestock. It is significant, however. that most of the major research studies that have analyzed the situation in depth reach much more optimistic conclusions. Their forecasts of production. consumption, and prices for at least the next decade or so vary somewhat. But they agree that most of the recent supply problems are transitory and should and can be corrected and that production can and probably will manage to keep ahead of population and income growth, although with frequent and possibly severe temporary shortages.

The major recent studies on projections of world grain reduction and demand have been made by Iowa State University-197 3 but with a late 1960's base the United Nations' Food and Agriculture Organization—1974 with a 1969-71 base, the USDA's Economic Research Service-1975 with a 1969-71 base, and the Brookings Institution—still in progress.

Following are a few general conclusions on which most of these studies are in agreement..

In their view, the problems of the past few years, to some extent, carry within themselves the seeds of their own solutlons. Food prices were too low and too often artificially restrained in the late 1960's and early 1970's, and low prices discouraged fertilizer production. The anticipated higher level of grain prices will stimulate production and inhibit the rate of growth of livestock feeding. Fertilizer prices should remain high enough to stimulate an increase in production of that vital input. Perhaps most importantly, the nations of the world recognize better than ever before the seriousness of the situation and the determination of their peoples to improve their diets. Thus, they are making an unprecedented effort to raise more food and distribute it more equitably.

In the short and medium term, all agree, the developing countries will probably continue to increase their dependence on food and fertilizer imports. For years their own food production remained below Potential due to such deterrents as low food price ceilings, availability of food aid, and cheap food imports. The recent jump in prices will stimulate food production, although high fuel and fertilizer prices and shortages of foreign exchange may, for the moment, inhibit rapid development. Temporary increases in food aid provided by affluent countries will be necessary, along with longer range development assistance programs.

These researchers reach other general conclusions about the next 10 years :

(1) Real food costs will remain high temporarily, but will probably decline relative to other goods to somewhere between the excessively low pre-1972 level and the 1973–74 levels.

(2) World food resources are adequate to permit continued per capita increases in food production for at least the rest of this century, if not well beyond.

(3) Instability of food supplies and prices will continue unless adequate reserve stocks can be built, up.

(4) Little evidence exists that global shifts in climate of a long-range nature will adversely affect production.

(5) The serious reconsideration of agricultural policies and their adaptation to changing conditions which is underway in most countries must continue to be carried out if these reasonably optimistic projections are to be fulfilled.

A few of the keu ***projections*** made by their studies may help bring these conclusions into focus. Both FAO and ERS take as a base the 1969–7l average. altough they use a slightly different mix of components. FAO forecasts the net annual import deficit of developing countries will jump from 16 million metric tons in 1969–'71 to 85 million metric tons by 1985-this would rise to 100 million metric tons if net exporters are eliminated. ERS uses several alternative sets of assumptions, but under the first two 'alternatives the 1985 forecasts would be for deficits of 49 million and 68 million metric tons—66 million and 88 million metric tons, eliminating the LDC exporters-Thailand and Argentina. Another ERS alternative assumes annual usage of an additional 1 1/2 to 2 percent of fertilizer and related inputs, which would reduce the annual import deficit to 36 million metric tons 10 years hence.

While food deficits of this magnitude could be met by surplus production from developed countries, the developing countries would probably have serious difficulties in financing them. The United States and other exporters may be faced with hard decisions as to whether to greatly expand development assistance or to increase even more their programs of food aid~through grants and credits. The importance of having an integrated food policy as a basis for making such decisions is again evident.

The ***U.S.*** *outlook.— As* to the prospects for U.S. agriculture during the next 10 years. an ERS study is currently underway on projections to 1985, for which preliminary and as yet unofficial figures have ***been*** released, Two sets of assumptions were used to make projections. The first, called "Baseline Demand,"' assumes: (1) GNP' growth at 3.98 percent (in 1958 dollars) annually, equal to the rate during 1960-74, (2) the Census Bureau's series :E'' population projection (see table I), and (3) a moderate export assumption, with continued restrictions by the EC, greater participation than previously by the U.S.S.R. and China as grain buyers in the world market, and steadily increasing imports by developing countries.

The report also made a "high demand" projection based on higher population levels, income. and export assumptions, which would show a boost of about 9 percent in prices received and in net farm income of nearly 20 percent from the baseline projection. The second projection assumes: (1) GNP growth (1958 dollars) 4.1 percent, (2) Census series "D" population growth, (3) export demand assumptions-(a) slightly higher imports by U.S.S.R. and China, (b) somewhat liberalized EC trade policy, (c) faster than trend growth by the developing countries' livestock economies, particularly in OPEC countries.

TABLE I.—U.S. OUTLOOK BY 1985

	Baseline demand	High demand
Per capita disposable personal income (in 1958 dollars) ($2,846 for 1974)	$3,823	$3,739
Population (in millions)	236	244
Crop production index (1967=100)	133	141
Livestock production index (1967=100)	118	118
Farm output index (1967=100)	126	130
Volume of farm exports index (1974=100)	122	140

Source: Unpublished report of ERS's economic projections program.

By comparing these two projections, we can see the' dramatic effect that, even a moderate shift in world demand can have on prices and incomes of U.S. farmers. For example, U.S. wheat exports under the "high demand projection would go up by more than one-third and the U.S. farm price would jump from the baseline projection $3.73 to $6.24 per bushel! The increase in feed grain exports would be less dramatic, but as noted total farm exports would go up by 15 percent and farm incomes by 20 percent.

TABLE II.-U.S. CROP FORECASTS BY 1985

[In millions of bushels]

Commodity	Production		Exports		Price (1974 dollars)	
	Baseline	High demand	Baseline	High demand	Baseline demand	High demand
Wheat	2,059	2,530	1,165	1,610	3.73	6.24
Corn	6,561	6,741	1 9 5	1,735	2.33	
Grain sorghum	1,078	1, 087		239	2.10	2.38
Barley	479	472				2.04
Soy beans	1,778	1,829	806	812	7.03	7.36

*

Source: Unpublished report of ERS's economic projections program.

On the other hand, although no specific projection was made for an assumption of 'below-trend world demand, the logical conclusion is that U.S. farm prices and incomes could fall disastrously, using the same elasticities of demand.

Our critical need for a better information system could not be better demonstrated than by these projections. The price inelasticity of U.S. farm products dictates some fine economic tuning in the coming years, but as of now our economists simply do not have the necessary data. The scope of the information problem on a worldwide basis is overwhelming indeed. Think for a moment of the sophisticated crop data gathering system we have in the United States. It is far and away the best in the world, but monthly revisions of crop forecasts have frequently been large enough to make front page news. Now imagine trying to make sophisticated world crop forecasts from data which at best is provided by a country whose information gathering system is of a much lower caliber or at worst where countries outrightly refuse to provide any information. We have relied far too long on the educated guesses of agricultural attaches.

SUMMARY

The major new elements in the United States and the world agricultural outlook that have vastly increased uncertainty and instability are:

(1) The rapid dissipation of world food reserves to minimum pipeline levels and the disappointing progress in the ongoing negotiations for an agreement to rebuild them.

(2) A continued upward trend in the productive capability of developed countries, leading to potential short-term surplus, price-depressing conditions.

(3) A growing, but erratic and unpredictable increase in import demand from the developing countries, as well as the centrally managed economies.

(4) A U.S. commitment to eliminate hunger from the United States and to take the lead in eliminating it from the world. However, there appers to be a reluctance to provide the funds required.

(5) The sharp upturn in the rate of increase in the costs of produc-l-ion of farm products, which in the case of livestock feeders includes feed prices themselves, that makes U.S. farmers vulnerable to serious losses when prices move wildly in either direction.

(6) The increased tendency of retail food prices to move like a ratchet, upward quickly and easily but with great resistance to downward movements when farm prices decline—due partly to inflating handling and processing costs. This will cause great concern and real economic hardship to consumers, particularly those in middle- and low-income categories.

(7) The failure of the existing U.S. and world information systems to provide the inputs necessary to cope with the far more interrelated anti complex food problems facing the world today and tomorrow.

(8) The increasingly strident demands of the developing countries for a "new economic policy" that would seek out programs for redistributing wealth from the affluent countries to the poor ones.

(9) The runaway inflation of the past few years that even worldwide recession has failed to arrest.

II. CURRENT AGRICULTURAL POLICY—ITS LEGAL FRAMEWORK AND ADMINISTRATION

LEGISLATIVE BACKGROUND

In the light of these new elements in the U.S. and world food situations, we need to examine the current legislative authorities, policies, and institutional structures. They were primarily created and shaped to deal with the problems associated with surpluses. A review of the (Compilation of Statutes administered by the U.S. Department of Agriculture emphasizes this point. Many of the basic authorities regarding various commodities relate back to the Agricultural Adjustment Act of 1938. The Agricultural Adjustment Acts of the 1950's and 1960's, in most cases, tie back to that 1988 act. The mechanism for accomplishing needed adjustments is the Commodity Credit Corporation, a unique Government Corporation with comprehensive commodity and funding authority. Parts of man-y other programs administered by the Department of Agriculture such as conservation, credit, research, quality standards, or special export programs are basically geared back to the adjustment function.

Many of the existing legislative authorities are not ideally suited to deal with an unstable situation of closely balanced food supply. As examples, no effective measures were readily available to ease the impact on consumers and livestock 'producers when soybean and grain in'ices soared in recent years. Later, when the costs of producing grain soared as prices declined, grain producers felt the pinch. Again, the legislative authorities and Government structures were not sufficient to deal with the problems.

It is helpful to review the major changes that occurred in legislative authority and agriculture policy in recent decades. The most significant changes occurred in the 1960's when loan and purchase rates were lowered to estimated world levels and supplementary payments were provided for cooperating producers who agreed to restrict production. The two recent legislative changes, the Agriculture Act of 1970 and the Agriculture and Consumers Protection Act of 1973, while modified and improved over the programs of the 1960's, were nevertheless patterned in the same theoretical mold.

ADMINISTRATIVE PHILOSOPIIY

Despite the consistent legislative authority, the divergent philosophies of its administrators resulted in sharply differing outcomes. The current administration defines its national food policy as one directed toward the efficient production and distribution of the agricultural output in a completely free U.S. and world competitive market with only minimal government involvement.

The current administration has given modern expression to the 18th century laissez-faire, laissez-passer economic philosophy of Adam Smith and the French economists, which involved opposing all government interference in economic affairs except to maintain property rights. This classical economic approach relies on an assumed automatic coordination with competitive market prices providing the appropriate incentives or discouragements to producers of goods and services to thereby create (TheWealth of Nations.»

The Secretary of Agriculture has not only voiced this laissez-faire philosophy in numerous speeches but has gone as far as the law allows to eliminate or hold down agricultural price supports to a point where they have no meaningful effect on free market price adjustments. The Department's internal directive on program goals and objectives makes very clear indeed the policy of minimizing Government intervention an1emphasizing a market-oriented approach.

However, the administration apparently forgot its devotion to the laissez-faire free market concept in those cases where the result of that free market has caused political problems from the public, consumer sector. The recent embargo actions are examples.

The mind-set, and active striving toward the goal of coordination and adjustment of food production and distribution through market prices, with no Government interference, left the country. unprepared to trike timely and appropriate action to cope with the serious crises and pressures that have recently been encountered.

The hard economic facts of world shortages and skyrocketing prices caused by weather, sea current shifts, policy changes in non-free-trade countries and other unpredictable events combined with such known factors as world population increases, U.S.S.R. detente, Red China rapprochement a rising consumer movement. and the divergent interests of feed grain and livestock producers forced sudden price and export controls in June 1973 from a reluctant administration.

The importance in theorv and usefulness in practice of the competitive market price system for making adjustments in production, exports. imports, domestic use, and stock levels is fully recognized. It works relatively well for most agricultural commodities most of the time. However. recent events have made clear that unduly wide quantity and price fluctuations will not be acceptable in our domestic society either to consumers or to farmers. The power of the consumer movement, which was reflected in the administration's reluctant market control actions of 1973, 1974, and 1975 will surely grow and become more potent in any future crises. On the other hand, when agricultural prices fell precipitately from October 1974 through March 1975 while production costs rapidly rose. the need to protect farmers became expressed in the near override of the President% veto of the farm bill passed by the Congress in the spring of 1975. This farm bill primarily would have increased the target price support for feed grains, wheat, and cotton to their approximate cost of production levels and would have reestablished a support program for soybeans.

APPRAISAL

A total market-oriented-laissez-faire-approach to food today just is not sufficient. It is acceptable in our present U.S. society and world situation only within reasonable market price changes. It fails to touch or provide answers for many of the most pressing problem as aspects, responsibilities for which and decisions on which reach into nearly all our existing governmental departments and agencies. The various Presidential and interagency committees established to effect some coordination in limited spheres are insufficient to properly meet the overall coordination required. What is needed is a flow of up-to-the-minute data, information, and analyses from all the agencies concerned with food to a centralized organization. This organization should be charged, on a continuing basis, to exercise judgment and reach decisions reflecting all input aspects and approaches and possess authority to effectuate coordination.

GOALS FOR A NATIONAL FOOD POLICY

This paper proposes a broader, more pragmatic, more consciously planned approach to developing and effectuating a national food policy. Such an approach involves weighing and balancing the varied, often conflicting, group interests and attitudes in terms of broadly conceived general welfare. It involves the international status, obligations, and policies of the United States. It involves and leans heavily on a greatly improved flow of data and information to enable human judgment to coordinate all these factors in ways which best meet our national interests and which are acceptable to the Congress and to the public as a whole.

A comprehensive and consciously coordinated national food policy should be framed in terms of a body of broad general objectives which would :

(1) Provide adequate supply and reasonable price stability to consumers;

(2) Assure fair returns to farmers;

(3) Provide assured supply for a continuing high level of commercial exports;

(4) Provide an available supply for feeding programs or disaster relief at home or abroad;

(5) Enable the United States to fulfill its international commitments and attain its objectives in food matters;

(6) Improve nutrition at home and abroad; and

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(7) Develop improved information and evaluation systems to better achieve the above objectives, including effective informational flow back to the American people.

GUIDELINES FOR DEVELOPING A NATIONAL FOOD POLICY

A national food policy created to meet these objectives is not only possible and desirable, but essential. If the United States is to fully utilize its food supply capability in order to maximize not only the economic benefits but also the political and social benefits, we must come forward with an organized, coordinated? planned national food policy. This can and must be coordinated with our free enterprise, market-oriented economy. This policy must help to guide that free market economy. It must set parameters so as to minimize economic disruption and hardships to all segments of our society.

A national food policy would involve an assessment of the total food requirement for a 10-year period. This would include domestic commercial demands, domestic food assistance programs, commercial exports, food aid exports, and contingency stockpiles.

In several of the above requirements, basic policy questions are evident, and congressional action would be needed. It is proposed that the Congress would ratify or ‘approve the 10-year national food policy prior to its implementation.

Given these national food requirements, the executive branch would then determine the conditions and inputs to obtain the matching supplies. This would involve: (1) Price and income incentives; (2) basic and applied research in production, marketing, and nutrition; (3) adequate credit; (4) adequate transportation; (5) availability of production inputs, such as energy, labor, and chemicals; and (6) efficient processing and marketing systems.

The development of such a 10-year national food policy within the framework of a basically free and market-oriented society must involve many facets of our economy. It must include the inputs and best thinking of farmers, agribusinessmen and researchers, et cetera. But only government can provide the catalytic action, the leadership, and the coordination to bring the best points of view into a decisionmaking process. Congress and the executive branch must accept this responsibility.

The primary purpose of this paper is not to fully develop the concept and applcation of a national food policy. Hence, we have only outlined a skeletal approach to provide the necessary background for evaluation of the alternative government structures for carrying out such a food policy.

III. Analysis of Present Institutions

PROLIFERATION OF DECISIONMAKING

Preceding sections of this paper give some insight into why, until recently, there has been little or no consideration given to developing, proclaiming, and explaining a well-enunciated national food policy and a coordinated approach to handling matters relating to food. United recent years, we have struggled with a very real supply control or farm problem. Now we face what appears to be also a very real and long-term food problem. The rapid-fire events and changes of recent years, the need for more exacting data and analyses, and dire consequences of inaction now dictate a bold new approach.

With a very thin supply/demand margin, we can no longer leave the welfare of consumers and farmers to a widely fluctuating free market, especially when central governments can exert such strong market influences. The United States, in particular, and other producing and consuming countries have a vital stake in the rationalization of the food picture.

As each crisis emerged in recent years, a new short-range patchwork decisionmaking procedure was quickly inaugurated, generally at the White House level. The effect has been to give to others rather than the Secretary of Agriculture greater and eater responsibility for food policymaking. In addition, it has resulted in an almost unbelievable number of councils, boards, agencies, and committees—many overlapping and duplicating, but all designed to pull together the necessary information for high-level decisionmaking. Not only the White House has been responsible for this proliferation of decisionmaking and coordinating %0dies. Several have been spawned by the Congress. This whole situation is reflected in the Washington cocktail joke that agriculture and food have become too important to be left to the Secretary of Agriculture.

TWENTY-SIX DECISIONMAKERS

It is extremely difficult, if not impossible, to indicate each and every organization, department, bureau, agency, council, board, and committee that has by law or executive oder been given some significant responsibility for at least one aspect relating to food. Many involve the inputs to agriculture, some involve the production process itself. Others involve marketing, distribution, and quality control. A number affect the overall supply and utilization of food-particularly when consumers and voters are up in arms over food prices.

This paper will attempt to enumerate the major agencies, departments, or Government bodies that have some significant input in the total food equation.

(1) Department of Agriculture, with its 23 agencies, has the prime responsibility for many aspects of food, its production, and use.

(2) Department of Labor, through its Rural Manpower Service of the U.S. Employment Service, its Office of Manpower Development programs, its national migrant workers program, and its administrative responsibility for occupational safety and health, is deeply involved in a number of aspects relating to food.

(3) Department of State, with its Under Secretary for Economic Affairs, its Under Secretary for Political Affairs, its Assistant Secretary for International Organization Affairs, and, of course, its semi-independent Agency for International Development and its coordinator of the food for peace program, is likewise involved.

(4) Department of the Interior has inputs in the food area through its Bureau of Land Management which controls livestock production cm Federal lands; its Bureau of Commercial Fisheries; its Bureau of Reclamation; and its Office of Land Use and Water Planning.

(5) Department of Commerce and its Domestic and International Business Administration works with businesses involved in the processing, handling, exporting of food products.

(6) Department of Army, Corps of Engineers with its jurisdiction over the Nation's water **resources** envelopment actually has tremendous effect on agriculture.

(’i) Department of Health, Education, and Welfare plays an important role particularly through its Food and Drug Administration.

(8) Department of Transportation has at least seven entities directly involved in transportation matters which have major impact on the supply of productive inputs or the transportation of raw or processed agricultural commodities.

(9) Federal Energy Administration. with programs of allocation of energy supplies to agriculture, is deeply involved. Its decisions affect the ability of farmers to produce food and its proper handling and processing.

(10) Treasury Department plays an important role particularly under the current Government organization which brings the Secretary of Treasury into nearly all economic decisions.

(11) Farm Credit Administration, supplying nearly one-third of the capital needs of agriculture, is involved .

(12) Central Intelligence Agency, with its analyses of world production, has become a significant part of the decisionmaking process.

(13) Environmental Protection Agency, with its rulemaking authority in the agricultural field, can greatly increase the cost of food production as well as affect the ability of farmers to produce the quantities of food needed.

(14) Federal Trade Commission, with its responsibilities over legislation affecting competition. is involved in food policy.

(15) Federal Maritime Commission is concerned with the conditions of export of product~including food products.

(16) Federal Reserve, with at least six of its banks located in heavily productive agricultural areas and with its decisions so intricately interwoven with national economic policy, is a key factor in the food decisionmaking process.

(17) Commodity Futures Tradinq Commission, recently established to relate futures trading, has a significant role or effect.

(18) International Trade Commission, with its enforcement of import and export policies, affects food reduction and distribution.

(19) Office of Management and Budget plays a major role in determining food production and utilization through its influence on policy and expenditures.

(20) Domestic Council, charged with long-range planning and with making Presidential and legislative recommendations is involved.

(21) Council of Economic Advisers provides significant analyses and inputs into decisionmaking processes involving food.

(22) Council on Wage and Price Stabilization, particularly during its most active period of the early 1970's, had tremendous influence on agricultural policy.

(23) Office of Special Representative for Trade Negotiations is a key actor since agricultural trade is the largest single item involved in our balance of payments and, as a result, greatly affects how much farmers will be paid to produce food.

(24) National Security Council is involved in all major international political and economic affairs.

(25) Council on International Economic Policy was created by Presidential memorandum in January 1971 to improve the coordination of U.S. Government agencies in the field of foreign economic affairs. With food playing so important a role, the CIEP becomes part of the decisionmaking process.

(26) President% Economic Policy Board, established to advise the President concerning all aspects of national and international economic policy * * * and serve as a focal point for economic policy decisionmaking, has an important effect on food availability.

Each of the above has some responsibility for decislonmaking in matters that affect food policy. In many instances, a decision by some of the above can have not only short-range but very important long-, range effects. As an example of this, decisions in the field of energy have major impacts in the energy-intensive modern agricultural plant.

WHITE HOUSE INVOI.VEMENT

Since so man Government organizations are involved in one way or another in food policy and food policy implementation, it is only natural that one must look to the White House, which is the area of reconciliation and coordination, for the man-y, many inputs into the decisionmaking process. The following chart outlines the Executive Office organization for food issues. In addition to the groups, boards, and committees outlined in this chart, the Domestic Council and the National Security Council are, as noted above, both involved in many matters related to food.

The complexity of the issue—the emerging importance of food—is well indicated in the timing of the creation of various of these overlapping groups, committees, and boards. On September 30, 1974 the president created the Economic Policy Board. On October 30 l974, the President established an executive committee of the Board, modifying his June 18, 1974, organization of the President's Committee on Food. That committee was charged with "reviewing governmental activities significantly affecting food costs and prices and provides coordination for the Nation's policies relating to domestic and international food supplies and relating to food costs and prices." The October 30 memo also classified the position of the Food Deputies Group. In addition to this and not shown on the attached chart is a "Monitoring Group" which will daily review agricultural export orders. The most significant export, orders are to be submitted to the Deputies Group for decision.

Executive Office Organization for Food Issues

World Food Conference Follow-Up

PRESIDENT

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International Food Review Group

Secretary of State - Chairman
Secretary of Agri. - Vice Chai
Secretary of Treasury
Deputy Sec'y of State
Director, OMB
Chairman, CEA
STR
Executive Director, EPB
Executive Director, CIEP

IFRG Working Group

State - Chairman
USDA - Vice Chairman
CIEP
STR
NSC
OMB
CEA
Treasury
AID
Commerce

Economic Policy Board

*Sec'y of Treasury - Chairman
*Asst. to President for Economic Affairs - Executive Director
*Sec'y of State
Sec'y of Interior
Sec'y of Agriculture
*Sec'y of
*Sec'y of Labor
Sec'y of HEW
Sec'y of HUD
Sec'y of Transportation
*Director, OMB
*Chairman, CEA
*Executive Director, CIEP
Chairman, Bd. of Governors, Federal Reserve

Food Deputies Group

CEA - Chairman
Treasury
State
Commerce
USDA
Domestic Council
OMB
CIEP
NSC
CIA
STR

MB

Asst. Sec'y Representation from

OMB - Chairman
NSC
CIEP
USDA
State
Treasury
Commerce
Defense

Interagency Staff Committee

USDA - Chairman
State
Treasury
Commerce
Defense
AID
OMB
NSC
CIEP

*Executive Committee Members

On November 10, 1974, the Secretary of State established, under Presidential direction, an international food review group shown in the upper left-hand corner "to coordinate the implementation of the U.S. decisions and initiatives stemming from the World Food Conference * * * and make recommendations on further actions to be taken to implement the measures announced at the Conference." This follow-up group is also required to '(coordinate" with the executive committee of the Policy Board. With the six groups as indicated in the chart, plus the Monitoring Group plus the National Security Council, plus the basic responsibilities of the Secretary of Agriculture, it is quite clear that there is no coordinated decisionmaking process on matters related to agriculture. Given this organization, one is tempted to suggest that a new organization be established to coordinate the coordinating groups. It is clear that Government structures must be changed and that change be accomplished in the immediate future if the asset we have in the area of food is to be developed and maximized to the best interests of the United States and the world.

IV. ALTERNATIVE GOVERNMENT STRUCTURES

In light of the foregoing, it is apparent that our decisionmaking process with regard to food is highly unsatisfactory. With the growing worldwide demand for food, our entree process of food production, marketing, and distribution-both domestically and internationally—dictate the need for a more precise, better coordinated information-gathering structure and decisionnmking process. The tolerance of error is so small that the system of compartmentalized and independent decisionmaking on the part of the several Government bodies is no longer viable.

This paper presents three alternatives to this problem. Each is designed to focus into a single decisionmaking forum all of the inputs, information, intelligence, provisions, and policy choices-whether relating to political, economic, or social factors. The three alternatives represent a progression from simple to complex, from minimum change to major restructuring, from mere coordination to monolithic policymaking and implementation, from minimum Presidential action to full congressional consideration.

ALTERNATIVE NUMBER ONE—A NATIONAL FOOD COUNCIL, HEADED BY A SPECIAL PRESIDENTIAL ASSISTANT FOR FOOD

Under this alternative, a special assistant--or counselor-for food would be designated by the President. A food council involving the Cabinet officers from appropriate departments would be established by the President. No new legislative authority is necessary. Presidential authority clearly exists to reorganize White House staff functions.

A special assistant to the President for food would have the responsibility to formulate recommendations for a general, long-range national food policy. He would have the power to convene the food council and to coordinate inputs from various departments and agencies pertinent to the problem at hand, to request studies, analyses, et cetera, from any department or agency of Government. He would serve as a catalyst, coordinator, and convener. He would structure the agenda and cause the council to focus on issues at hand, whether long-ran e policy or short-range urgent decisions. Actions or considerations of the national food council would be relayed to the President, who would direct appropriate Cabinet officials accordingly. In short, the special assistant for food would gather facts, analyses, viewpoints, and form these into recommendations for the President. Individual Cabinet officers would have the clear opportunity to present differing recommendations directly to the President

The council, under the chairmanship of the special assistant for food, would be empowered to deal with any matter **relating to** the total food picture. This could include matters relating to basic research . in production, use, or distribution of food, the availability of inputs required in basic production policy, recommendations as to domestic or international policies relating to the production incentives or deterrents, consumption patterns, etcetera.

O rating through and with the council, the special assistant for food would coordinate food aid programs, allocation or embargo programs in commercial sales recommend new legislation and coordinate varying legislative and policy positions. Operating independently or through the oouncil, he would have the authority to use public advisory committees. He would, when appropriate, brief members of Congress–Committee leaders, et cetera-but would not normally appear directly before congressional committees. The appropriate Cabinet officer would car out this function. Neither the council nor the special assistant would have final decisionmaking authority and all implementation would be accomplished through the independent agency or department. While the President would decide the membership of the food council, it is likely that he would at least designate the Secretaries of Agriculture (perhaps as vice chairman), State. Commerce, and Transportation. The Council of Economic Advisers, Office of Management and Budget, AID, National Security Council, and Central Intelligence Agency and Domestic Council might also be represented.

The special assistant for food would have a small core staff, probably no more than 10. In addition, there might be a second echelon working level group from the member departments or agencies designated to flush out problems, pending issues, etcetera, for consideration by the food council. It is anticipated that the council would meet at least monthly, with the second echelon group meeting more frequently.

The "coordinating concept" here envisioned has been used on previous occasions. As the energy issue developed: President Nixon designated a special assistance for energy policy, with a similar coordinating, convening, and catalytic role. The existing White House organization is not as clearly structured for obtaining inputs from all concerned Government officials and departments.

ALTERNATIVE NUMBER TWO--NATIONAL, FOOD AGENCY, HEADED BY A CABIN-ET-LEVEL FOOD ADMINISTRATOR

This agency would have policymaking authority in any matter relating to food. The administrator would have overriding authority, subject only to the President or the Congress. on policy matters relating to food. Implementation of decisions would remain with the various departments as appropriate. Under existing authority, the President could create this new agency, but legislative concurrence, authority, and the necessary appropriations would be congressional actions.

It is envisioned that this organization would involve up to 100 technical experts in each and all facets relating to food from research to intelligence and assessment of food requirements of peoples throughout the world. The administrator wouldhave full authority to call on various agencies and departments of Government for analyses, studies, et cetera. He would report directly to the President,.

A Cabinet-level food committee or board would be established involving those agencies that have direct and significant inputs as relate to food. Clearly, the Departments of Agriculture, State, Commerce, and Transportation would be involved. but additionally AID, the Council of Economic Advisers. National Security Council, Central Intelligence Agency, and Office of Management and Budget would probably be included.

This Cabinet-level food committee would assist the Administrator in developing national food policy. It should meet at least monthly, with second echelon Under Secretaries, Assistant Secretaries, or Administrator's representatives meeting more frequently, Staff representatives from the NFA would work closely wit their technical and designated policy counterparts in each of the agencies. The NFA staff would likwise have responsibility for followup to assure that policy decisions of the Administrator are being carried out by the appropriate departments. Individual Cabinet officers would have the opportunity to review and appeal NFA decisions to the President.

The Administrator of NFA would have the authority to use public advisory committees, but would most likely work through the individual departments in developing national food policies. The agency would be responsible for establishing all policies relating to food, coordinating their implementation through Presidential directives to existing agencies. The Administrator would brief and report to the appropriate congressional committees and would present official administration testimony in the area of national food policy.

ALTERNATIVE NUMBER THREE-.~ NEW DEPARTMENT~ OF FOOD

The increasing importance of food suggests the advisability of considering a basic reorganization of the governmental structure. Such a new food department would gather' together the responsibility and authority for a variety of functions now scattered in several departments, agencies commissions, boards. and committees that have a direct bearing on our total food supply, its price, its quality, and its' availability for domestic consumption, including food assistance, and commercial and food aid exports.

From within the existing USDA structure, the new agency would assume the functions now performed by the Agricultural Stabilization and Conservation Service, Foreign Agricultural Service, Commodity Credit Corporation, Agricultural Research Service Packers and Stockyard Administration?, Agricultural Marketing Service, Animal and Plant Health Inspection Service, Food and Nutrition Service, Federal Crop Insurance Administration, and Farmer Cooperative Service. Portions of other agencies such as Economic Research Servire, Extension Service. Statistical Reporting Service, and Farmers Home Administration would be included as would some other minor functions from other agencies. The remaining functions currently in USDA involving the Forest Service, rural development, rural electrification, conservation, et cetera, would be involved in a separate reorganization plan.

At least the following functions from other departments would be included in this new Department of Food: The Department of Labor-those that deal with farm labor; the Food and Drug Administration-those dealing with the health, safety, and wholesomeness of food; the Department of State-those primarily responsible for international negotiations involving food; AID—those that involve food aid; the Department of the Interior—those in the Bureau of Land Management relating to the use of Government-owned lands for grazing; and the Department of Commerce-those relating to food processing and marketing.

There would be cases where a particular function logically fall in either of two or three departments of Government. In these cases, should the decision be to not include the function in the Department of Food, then appropriate and close liaison procedures would have to be worked out so that the Secretary of Food would have full input into the decisionmaking process affecting food production, distribution, and utilization.

Two examples where the advantages and disadvantages are approximately equal involve energy and transportation. Few other industries are so dependent upon energy in the entire chain of production and utilization than is agriculture. Natural gas is, of course, a basic ingredient in nitrogen fertilizer production. Supplies must be made available *on a* timely basis for efficient production. Likewise, perishable commodities must be moved promptly when ripe and read for harvest. Sufficient supplies of appropriate fuels must be available for planting, and harvesting, and process* . Likewise, in the case of transportation, farm to market roads, effective rail systems, barge transportation, are all part of the process of moving commodities to the farm, to the processor, to the market, and to the consumer, at home and abroad. The Secretary of Food must have an input in these areas, whether through his own organization or through a very carefully designed liaison procedure.

In other cases where national economic policy is involved that could affect food production, a new Secretary of Food would, of course, sit on Cabinet-level committees. The implications affecting food could be raised and considered through that approach.

This third alternative involves basic reorganization of 'the executive branch.. It would require Congressional action. Its total bud would be somewhat larger than the Department of Agriculture budget now, but considering that costs for other departments would be reduced and greater efficiencies would likely result, the total cost to taxpayers should be reduced. obviously, the Secretary of Food would present legislative proposals to Congress, make reports, and testify on food policy. He would have the benefit of public advisory committees. He would report directly to the President and would be part of the President's top decisionmaking team. In this way, the necessary information and inputs concerning agriculture would be included in final decisions made by the President.

RELATIVE ADVANTAGES AND DISADVANTAGES OF ALTERNATIVES

While each of the three alternatives has certain advantages and disadvantages relative to the other two, it should be noted that any of the three three would be preferable to the existing conglomeration 01 boards, commissions, councils, and departments. Even the first alternative, while somewhat similar to the existing system, offers a much more clearly structured and delineated method of coordination.

From a management standpoint, the assignment of total responsibility relating to food, inherent in alternative No. 3, is preferred. The public, the Congress, the President would all know who is responsible for matters relating to food either in the policy or implementation area. The straight and clear-cut lines of responsibility are a distinct advantage. Decisions are likely to come quicker, since the tools of research and analysis will be readily available. Duplication of effort in various departments, bureaus, and agencies should be minimized, if not eliminated.

On the other hand, the extensive governmental reorganization process that is embodied in alternative No. 3 could offer serious obstacles. These are likely to occur first within the administration where there probably would be great reluctance on the part of an Cabinet and agency head to give up his independent role. Also wit " the executive, this reorganization would create considerable disruption Morale could suffer while changes are being made until individual employees understand their roles in the new organization. In addition, the legislative reorganization would not just involve the executive branch but would require approval by Congress. Here, built-in special interest public groups could and likely would create considerable opposition. At best, a great deal of time would be lost in an area where immediate action is necessary. At worst, opposition might result in nothing being done.

Comparing the ease of implementation, alternative No. 1 stands nighest. A Presidential order can be issued within a matter of weeks setting up a Special Assistant for Food and a National Food Council, and a degree of coordination so desperately needed could begin almost immediately.

However, the Food Coordinator or Special Assistant for Food would not have final decisionmaking responsibility. He could only recommend. Hence, from an efficient management standpoint, considerable time and effort would be lost while the President, or others at the White House, considered the validity and desirability of a particular set of recommendations. Likewise, several Cabinet officers or agency heads could be appealing to the President with different viewpoints. It would be difficult to hold responsible the Special Counselor for Food without the authority to carry out the job. Since the Coordinator would be limited to consideration of top policy matters, and since the extent of coordination is limited to top officials of appropriate departments and agencies, many worthwhile ideas and effective evaluations from middle-level Government management could be lost.

Alternative No. 2, a Cabinet-level Food Administrator, with clearcut authority for decisionmaking at the policy level, ameliorates some of the disadvantages in either No. 1 or No. 3 but unfortunately also loses some of the efficiency and effectiveness of No. 3. In terms of timeliness, alternative No. 2 could begin almost immediately by Presidential order, although governmental legal advice indicates that congressional ratification would be desirable, if not essential.

The decisionmaking authority in alternative No. 2 is clearly more desirable than what can be envisioned under No. 1 and perhaps has an advantage over No. 3. The reason for this is that, in alternative No. 2, the decisionmaking officials would be relieved of operating and implementation responsibility. While there are pluses and minuses, this alternative does permit the top policymakers to devote full time to those decisions requiring their attention.

If Congress is to perform its full role in policymaking, alternatives No. 2 or No. 3 are preferable to No. 1. Under alternative No. 1, the Special Assistant for Food is a member of the President's staff. In alternative No. 2 or No. 3. the Food Administrator or Secretary would have independent status and must look to the Congress for appropriations and oversight.

Considering governmental cost or burden on the taxpayer, we find no significant difference among the three alternatives. But any of the alternatives would be preferable to the existing structures when measured on a cost-effectiveness basis.

As the preceding sections made clear, there are advantages and disadvantages to each alternative. Beyond these, the final choice would be heavily influenced by a variety of circumstances existing at the time of decision. For example, if a President desired a major government? reorganization and felt the congressional and public mood was supportive, he would probably lean towards alternative No. 3. If, on the other hand. he felt that the fight involving reorganization would, be so lengthy and disruptive as to delay complete coordination, he could turn to alternative No. 2. If the Chief Executive felt that there would be insurmountable difficulties in obtaining congressional concurrence with his changes, whether they be No. 2 or No. 3, and recognized the need to bring about more effective coordination and efficiency immediately, he would begin with alternative No, 1.

Likewise with Congress-the circumstances and conditions would determine their action. It would be most difficult to force a President into alternative No. 1 through legislative action. On the other hand, Congress could create an independent agency headed by a Cabinet-level official as in No. 2 and could reorganize existing governmental structure as in No. 3. It would be 'hoped this would be a joint decision by the executive and legislative branches with the best inputs from the private sector, from academia, and from within the career Governnment the congressional employee ranks. In this manner, the best choice could be made based not only on short-range but long-range consideration.

Thank you, Mr. Brown.

[The following questions were submitted by Senator Humphrey to Mr. Jaenke and his answers thereto:]

Question 1. Do you anticipate that in the future, Government Administrators will have to deal with both problems of excess supplies and threatened shortages ?

Answer 1. We indeed anticipate that in the future Government administrators will have to deal with problems of excess supplies and also of threatened shortages. There appears to be, rather *uniform* agreement that population will continue to outrun production in the LDC countries during the *next* ten years and that there will continue to be a significant world-wide expansion in livestock and livestock feeding. It is anticipated that the U.S. will increase its production more rapidly than its consumption and become more dependent on exports. The whole world's climatic and economic variations can be expected to impinge more and more greatly on. the U.S. as the world's major food grains and feed grains supplier.

Question 2. In your opinion is the legislative authority for dealing with threatened shortages, or occasional surpluses, adequate for supplementing our free free market system ?

Answer 2. In our opinion, the curreut legslative authority is inadequate for dealing either with surpluses or with threatened shortages.

The Agriculture and Consumer Protection Act of 1973 established target prices for corn of $1.38 and for wheat of $2.05 *for the* 1874 and 1975 crops and limited increases in the target prices for the 1976 crops to the cost increases in calendar year 1975 and for 1977 crops to the cost increases in calendar year 1.976. The period of the greatest increase in cost of production occurred in, the latter part of calendar 1978 and in calendar 1974. The target prices for the 1976 crops wiil soon be determined. These are certain to be unrealistically low and will provide little or no protection against a surplus.

There is no specific legislative protection for threatened shortages. The 1973 Act established a reserve to be acquired under the price support program. But supports are so unrealistically low-with none for soybeans--that this provision is ineffective. President Nixon applied export embargoes in the 1973 protein shortage situation as "national emergency" measures, and there have been subsequent export embargoes imposed on shipments to Russia and Poland by President Ford. Not only has legislative authority for these actions been debatable, but they have proved in many ways counter-productive both to *our* long-term export interests and to important farmer interests within the country.

Question 3. If it is not adequate, what additional legislative authorities *or* restrictions on government officials are needed?

Question 4. I understand that most of your clients are farm cooperatives and farm producer groups who are opposed to the establishment of a grain reserve program as proposed by the other members of the panel. Do you believe that a grain reserve program could be developed and administered in a manner which would benefit producers as well as consumers and traders?

Answer 3 and 4. The Agriculture and Consumer Protection 'Act of 1973 needs to be revised to provide protection to both farmers and consumers. Such legislation should include meaningful target and loan supports for wheat, feed grains and cotton and also for soybeans. The appropriate legislation for a reserve program for food groins, feed grains and soybeans that can benefit producers, consumers (including livestock farmers), and traders needs the most careful consideration and the input of all these groups. It must also take into consideration our country% international obligations and relationships. We believe that such legislation can he framed and that such a program can be developed and administered with general support from all groups, including producers.

Question .5. If you believe a reserve program could be administered in a manner to benefit producers, what are the key guidelines needed to assure that producers would benefit from a national or international grain reserve program?

Answer 5. You ask for the key guidelines needed to assure that producers would benefit from a national or international grain reserve program.

As we view it, a suitable grain reserve program should be interrelated with a suitable support program to the long run mutual benefit of grain producers, livestock farmers and consumers. While each group has its special short-term divergent interests over price there is an underlying basic mutual long-term economic interest. No one, except a few speculators, benefits from a roller-coaster boom and bust pattern of commodity prices.

A rise in meat prices so substantial as to give rise to a consumer boycott hurts the livestock industry and then the grain farmer. A rise in feed grain prices that bankrupts livestock farmers is tragic for that group and subsequently hurts consumers and grain producers. These very developments have occurred in the last three years.

On the other hand, the drastic fall in grain and soybean prices in the fall of 1974 and spring of 1975 was only arrested by the drought in the USSR and Western *Europe* and in the Western U.S. corn belt. Had rains occurred in these areas, grain prices, lacking meaningful support, and soybean prices, lacking any support, would probably now be well below cost. Quite obviously, grain and soybean farmers cannot be expected to continue to produce for consumers and livestock producers at below cost, This was recognized in the broad support aecorded the Farm Bill passed by the Congress last spring but vetoed by President Ford.

Factors other than meaningful supports needed to assure producers are:

A. Government purchase at the "meaningful" target price up to the desired reserve quantity.

B. A sufficiently wide margin between the acquisition (i.e., target.) price and 'the minimum sale price.

C. Arrangements to store on the farm or through farmer cooperatives if facilities are available and producers so desire.

D. A loan program at not less than a certain percent of target with reseal privilege and with conversion privilege for purchase at the target price" whenever the reserve is less than the desired quantity.

E. Clear understanding on either eliminating or greatly Waiting (Russia) export embargoes when reserves at protective levels are available.

Question 6. Your suggested alternative Government structure No. 2 appears to have advantages over the other two alternatives. What are the major advantages of this alternative Government structure over the existing situation in Government ?

Answer 6. Not everybody agrees with your conclusion that Alternative No. 2 is more advantageous than the other two alternatives. We ourselves however, do tend to agree with you in that No. 2 would more effectively coordinate the varied and conflicting interests and approaches than would Alternative No. 1 and could more feasibly and quickly be established and become operative than No. 3.

The advantages of Alternative No. 2 over the existing situation are:

A. Emphasis on the flow of information and data so that all aspects of food problems and all the interests, both domestic and foreign, can be weighed and taken into consideration.

B. Coordination of the decision-making process which is Row pulled in many different directions.

C. Improvement in decisions in that information on all aspects would be available to be considered and weighed in each decision made.

D. Improved coordination of the operating programs of the many agencies dealing with national and international food problems.

E. Improved and broader information flow on all aspects back to U.S. producers, processors, traders, and consumers and to foreign peoples.

Question 7. How would the responsibilities of the Secretary of Agriculture be changed by your proposed alternative No. 2?

Answer 7. The responsibilities of the Secretary of Agriculture would change very little under Alternative No. 2 *from* the present. He would, however, regain the active role in the decision-making concerning food that he has recently lost to officials from various other department and agencies.

Question 8. What in your opinion, are the major deficiencies in our current food information systems?

Answer 8. The major deficiencies in our current food information system involve:

A. The need for more complete and more up-to-date world information and analysis thereof on production, trade consumption and stocks.

B. The need for improved techniques of relating weather information to production potentials.

C. The need for improved information on domestic consumption and on stocks in the United States Stocks in presently unreported positions vary greatly with price swings.

D. Better coordination of the data now available, both within the Department of Agriculture, i.e., ASCS, FAS, SRS and ERS, and of Agriculture with Census.

E. Improvement in the present export sales reporting system furnishing breakdowns by quarters if not by months and improvement in the breakdown by type of contracts.

F. Improved analysis and forecasting through a better coordination of theoretical model development with practical knowledge of the industry and with the insight to spot changes.

Question 9. Do you favor an integration of the Census of Agriculture and the activities of the Statistical Reporting Service?

Answer 9. Yes. Now that the Census is using the sampling technique rather than attempting to cover the universe of the data, we think the SRS could do a better job. The SRS has developed better cross-check devices.

Question 10. What is the relationship between the Secretary of Agriculture and the Food Administrator?

Answer 10. We visualize a relationship between the Secretary of Agriculture and the Food Administrator somewhat similar to that which existed between the War Food Administrator and the Secretary in World War II. The Food Administrator would prepare and recommend food policy supported by all available data from all sources to the committee on which the Secretary of Agriculture, the Sec-

retaries of State, Labor, Transportation, etc., would serve but chaired by the Food Administrator. The policy so determined would be carried out by the various departments and agencies.

Mr. BROWN. Thank you very much, Mr. Jaenke. Your presentation has contributed a great deal to my own understanding of this situation, as I am sure it would every Member of Congress, and we appreciate it very much.

I am going to defer questioning until we hear the additional presentations and hopefully Senator Humphrey will be here also to participate in the questioning by that time.

I understand the next presentation represents a joint paper prepared by Professor Cochrane and Mr. Seth.

If I am correct in that, Dr. Cochrane, you may proceed and make your statement.

STATEMENT OF WILLARD W. COCHRANE PROFESSOR OF AGRICULTURE ECONOMICS, UNIVERSITY OF MINNESOTA, MINNEAPOLIS, MINN.

Dr. COCHRANE. Thank you.

We are going to divide the paper in the following way. I am going to talk about what we think are two great problems and what the policy solutions to them are.

Mr. Seth is going to talk or focus more on what the Government organizational needs of these problems would be.

Chairman BROWN. Do you have copies of your papers there?

Dr. COCHRANE. Yes.

Chairman BROWN. You may proceed.

Dr. COCHRANE. As I said, I would like to talk about what I consider to be two great problems confronting U.S. consumers and reducers of food. To an important degree, these problems arise in the United States from developments taking place around the world and, hence, make the policy confronting U.S. consumers and producers of food different from what we have been used to in the past and these problems are somewhat more difficult to deal with.

The first problem I would mention is what I call the food price trend problem. I expect the real price of food to increase over the next 25 years. This is in somewhat contradiction to the summary of reports that Ed Jaenke reported, and it is somewhat different than Professor Tweeten is going to say.

The other problem is the price variability problem, particularly the grains that Mr. Jaenke emphasized.

I think the position of Mr. Seth and myself on this variability problem and grains is almost exactly as our colleagues see it.

The price elasticity of demand for grains is very inelastic. We have weather fluctuations and fluctuations in growing conditions around the world. Small changes in supply create very great price movements. Since the United States is linked to this world market-I read where now we are supplying 50 percent of the grain moving in international trade—anything that happens in the Soviet Union or India in the way of variation in production is immediately reflected in price movements in the United States.

It seems to me that there is an increasing agreement that **the problem is here,** and it is not going **to** go away because ***weather* is not going** to become more stable. It is generally reed that private trade cannot deal with this kind of problem and the elasticity of demand is not likely to change.

So, although we cannot predict within any certainty whether the prices are going to go up or down next year, we can predict with almost certainty that this short-run variability problem will be with us and prices can and will move in the extreme.

I will not say more about this problem.

With regard to the long-run price problem, trends problem, there is a great deal more disagreement in this area.

We argue in our paper that the real price of food is likely to increase in the long run. We have not, in our paper, done elaborate econometric analysis of this. I am greatly impressed with the ones I see around the world because, basically. what everybody is doing is assumingthat what happened m the 1960's is going to continue in the 1970s and 1980's. If you put into your econometric model the growth trends of the 1960's, you get out of it as results in the 1970's the same as you had in the 1960%.

So if per capita food consumption around the world remained almost constant as it did in the 1960's, and if that is the stuff you put into your estimating models, that is what you get out in the 1970's and 1980's.

I will argue that the real price of food is going to increase for three different kinds of reasons. Two, I think, are certain as the sun coming up--well, not quite that certain, but pretty certain-and one quite conjectural, but I would like to raise it.

The first consideration are the supply considerations. It is commonly said there is plenty of land around the world.

With that I would agree, there is a lot of land around the world. The problem is that there is damn little land around the world that is readily available for cultivation. Even in our own country, when we bring in any new land, it is typically going to be low-yielding land or we have got to invest heavily. into it to make it high-yielding land, which means lands will come into production, if and only if product rices rise. The price of the product must rise enough to bring the poor land into production. You can make any acre productive if you will spend enough money on it.

The same holds true with regard to water. In I@@ you have got to pump it from lower depths. Here., you have got to move it longer distances.

Water is short. It can be obtained. You can convert sea water into fresh water if you want to spend enough money on it.

The point I wish to make is that both of **those** resources are becoming increasingly scarce and are going to be scarce, and the only way you can bring more of them into production is to pay more for them.

Turning to the demand considerations. In the 1960"s we were all surprised, impressed, and pleased with the great increase in the demand for grains in Western Europe. and in Japan to produce more meat in those areas. So our commercial exports of grains increased significantly in that period.

During the early 1970"s, we have seen Eastern Europe and the Soviet Union moved from exporters in grain to very large importers of. grain. Why? For the reasons Mr. Jaenke said, they want to maintain their livestock herds. They want to increase their per capita meat consumption.

What many people do not realize is that as development is occurring in the developed world, what is happening is that people in the developed world want to eat like people in the United States eat. They want to eat more meat) and they are importing grais from North America to do it.

Thiss has been a very important factor, tightening the international grain market. And as long as development occurs in the Western World, there is going to be increased demand for our grains to produce that meat.

The other demand factor is that the world population is going to double in the next 25 years. The young people who are already *on* the Earth are going to reduce the babies. So we are going to have to double our food production in the next 25 to 27 years, These factors are going to be very important demand factors, increasing demands for grain.

' The two conjectural considerations that I would mention that make the future tenuous are as follows: Farm technological advance is sputtering. I use that word "sputtering" advisedly. We have had no technological development recently comparable to hybrid seed corn in the United States of two decades ago.

What is going on around the world now is that we are refining many, many things. All of these refinements are helping to increase production. These refinements are slowly increasing food production per acre. But there has been no dramatic breakthroughs m the last 5 years. Maybe one will occur next year.

Maybe we will learn how to double the yield of soybeans. I will not say we will not. All I am saying is that farm technological advance is presently sputtering.

It is not pushing yields up with the regularly and persistence that occured in the 1950'sr the 1960's. That is one conjectural element of the future.

The second conjectural element is with regard to the weather. The Northern Hemisphere is cooling. It has been cooling for the last 25 years. These trends can run anywhere from 50 to 200 years in duration. I do not know whether the Northern Hemisphere is going to continue to cool, and a little ice age is going to come along in the next 100 years or not. All I know is it has been cooling for the last 25 years,

History suggests that these waves go in long movements. We also know that with the cooling of the Northern Hemisphere, that weather and crop growing conditions become more variable in the monsoon areas—-where the rains come in off the ocean. My guess is, or my judgment is, that on the basis of changing climate, that crop growing conditions over the next 10 or 20 years are not going to be any better than the last 10 or 20 years. And they could be a lot worse.

I admit these last two points are conjectural.

But I think there is enough substance to them that they need to be taken into consideration. They do not lend credence to the fact that you predict by just projecting the trends of the 1960's into the 1970's and 1980's and expect development to be the same.

Now, how do you deal with these problems?

With regard to the variability problem—there has been enough work in the last 5 years to suggest how you deal with a shortrun variability problem. We need to develop an international grain reserve program to deal with this problem. It can be done by the United States alone. The quantities involved are no more than we held in 1960. It could be done by the U.N. if the U.N. had the administrative capacity to do it, which I doubt.

And, as Senator Humphrey has heard me say in the past, I think it will most likely be done, if it is going to be done, by four, five, or six of the leading importing and exporting nations of the world getting together and forming an international agreement to stabilize gram prices.

How would this occur ?

One formulation could involve the stability of grain prices within a plus or minus 10 percent of trend. I am going to publish a document in the near future, probably within the next 2 months, which is going to suggest that we can stabilize world grain prims within 10 percent, plus or minus of trend, with an average reserve grain stock of 60 to '70 million tons, with 90 percent probability of achieving the stabilization objective.

You cannot make sure that you always hold the prices within a range, plus or minus 10 percent, without carrying a very large stock. This means that in 1972 or 1973 if such a program had been in operation, it would not have completely held prices within 10 percent of trend, but it would have kept prices from rising in the extreme fashion that they did.

So my first point is that we need an international reserve stock program.It is feasible in terms of the quantities. It is feasible in terms of achieving reasonable prices stability. The only thing that is lacking is wise and strong leadership from some of the leading nations.

If we can get some wise leadership from countries like Japan, United States, Germany, Australia, and Canada, such a program can be brought into being.

It seems to me that the United States, in light of our key position in the world, should provide the leading part of that wise leadership. And we are not getting the kind of leadership that I think we need to deal with this problem.

Mechanically, it is feasible. That is the point I want to make. It is not, out of the question. The people around this table could provide the administrative and type of economic advice that is needed to run such a thing. It is the leadership that is lacking.

With regard to the long-term problem-we have a very much more difficult, problem. To deal with it two things must happen. Or we must make them happen.

One is we have got to have a worldwide research and development program. an R. & D. program, with the capacity to bring about rapid technological advance again, not only in agriculture, but also in energy.

Because much of the technological advance in the last 30 or 40 years has been the substitution of cheap energy for human labor, we must have an effective worldwide research an development program that can step up the rate of technological advance in the energy field.

I think this is possible; the trained personnel in the world exists with respect to agriculture. The pattern of international research is established. I think again what we have to have here is more imaginative leadership on the part of the production scientists and more money in the worldwide research and development complex, But this is possible. We don't have it yet, but we can if we want it.

The other half of we have got to do-and when I say we, I am talking about the world now-is achieve a stable world population in 35 years. If we do not, then everything we are talking about here will be for naught.

In this connection I am very pessimistic because I do not see any of the countries where the rapid increases in population are taking place doing anything effective about it. In fact, they are saying quite the contrary. They are saying you are rich, and if we want tobreed, that is our privilege and you should help us support ourselves.

I know some studies that are going on in the new International Research Institute located here in Washington that suggest that the food gap in the less developed world will double in the next 10 years.

I am involved in some work which suggests that in the next 20 years, if we cannot stabilize world population, the amount of grain we will need to transfer to the LDC's is so great that you cannot even contemplate it.

Therefore, I am arguing that the long-run trend problem, is a very difficult problem, and it is not going to be easily resolved.

The short-run fluctuation problem is important, but here we know what to do about it. It is just a question of having the courage to do it and some political leadership that can get us moving.

Thank you, Congressman Brown and Senator Humphrey.

Chairman HUMPHREY. Thank you.

Lauren Seth, do you have some comments you wish to make?

STATEMENT OF LAUREN SOTH, WRITER-ECONOMIST, CHAIRMAN, NATIONAL PLANNING ASSOCIATION AGRICULTURE COMMITTEE, AND MEMBER OF THE OTA FOOD ADVISORY COMMITTEE, DES MOINES, IOWA

Mr. Sorer. Well, my colleague, Dr. Cochrane, has explained our paper so lucidly and extensively that I do not think there is much for me to say. But I would like to make a couple of points.

First, Senator Humphrey and Congressman Brown, the National Planning Association Committee on Agriculture will have a statement on national and agricultural policy released about, the 7th or 8th of January. I think you might be interested in it, it does not deal with international aspects as much as this hearing, but has some suggestions on adjusting our acreage bases for possible future use, and on price supports, commodity loans, and soon.

Chairman HUMPHREY. You will see we get a copy of that?

Mr. SOTH. Yes, I will get you a copy.[1] It was prepared by Prof. Harold Breimyer, University of Missouri, and there is a committee statement accompanying it.

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[1] The statement of the National Planning Association Committee 1s retained in committee files.

For the purpose of this hearing I should like to emphasize again, as I have many times before, 'and I know Senator Humphrey is interested in this, the importance of national planning and goals in a

I think I mentioned to you onetime before, Senator Humphrey that I would like to see more direct mention of agriculture in the bill by you and Senator Javits on agriculture; particularly m this world food situation that Mr. Jaenke and Dr. Cochrane have described so ably, it is essential **that we set some** production targets each year for leading commodities. We should have been doing that all along. We can do that under present legislation.

In order to have an agriculture plan that means anything, of course, you need the best available political and economic intelligence, and we can see in this current year that we certainly are not getting very good intelligence. In the middle of the summer, the Department of Agriculture was I think estimating a Russian crop of around 180 million tons——

Chairman HUMPHREY. Actually, higher.

Mr. JAENKE. The Soviet goal was initially 215 million.

Mr. SoTH. TIM Soviet goal was over 200 million. The first estimate by the U.S. Department of Agriculture was around 180 million.

Mr. SOTH. Then down to 180 million. Now, the latest guess is around 140 million. That is not all the fault of our people, of course, but it is the inadequate of the Russian reporting system. I mention that just to show that if you are going to plan a reserve program, a reduction program in this country, we obviously need far better intelligence on what is going on in our own country and around the world.

We have the 'best reporting system in the world. I know Harry Trelogan, recently retired Director of the USDA Crop Reporting Service, is in the room here, and he would be the first to agree that it could be improved.

We do need to put more emphasis on this matter of getting the best information available. My colleague and I have suggested toward the end of this paper that some reorganization and coordination of information-gathering and analysis in our Government would be helpful.

The responsibility for world food information now is split among three agencies in the Department of Agriculture. We believe there is some confusion of function in this setup. We could do abetter job of it. The foreign commodity analysis unit of FAS, we think, might well be transferred to the Economic Research Service. It is logical to combine those two staffs and place them under an agency which has no action responsibility. FAS does have a sales responsibility and as earlier statements before this committee have indicated, there is at least a suspicion of some conflict of interest there.

Necessarily, under our present setup, we have to get information on other countries to the agricultural attaches until such time that specialists in crop and livestock reporting might be substituted for these people. I stress again the importance of getting better information for our own policymaking.

We also need better analysis of the available data. And the logical agency for that is ERS, where most of the analysis goes on now.

If we are going to run this international reserve program that all three members of this panel agree upon, I think the first step is to take action to get better information and to insist, if we can, more effectively on better information out of the Soviet Union, the biggest single grain producer in the world.

Thank you, Senator Humphrey and Mr. Brown.

Chairman HUMPHREY. Thank you.

[The material referred to follows:]

[The following paper was submitted by Dr. Cochrane and Mr. Soth :]

FOOD AND AGRICULTURE POLICY CHANGES NEEDED IN LIGHT OF THE NEW WORLD FOOD SITUATION

(By Williard W. Cochrane and Lauren Soth[2])

(A Paper Prepared for the Office of Technology Asessment)

The United States needs changes in its food and agriculture policies and in government agencies to cope with urgent world food problem%

The recent agreement with the Soviet Union providing for a minimum annual level of grain exports to that country could become a significant stabilizing factor in world grain markets. But much more needs to be done to dampen down and moderate wide and unpredictable swings in agricultural prices-a problem that has been accentuated in the 1970's.

Tremendous pressures are placed on the American free market system by the lack of a free market system in most of the world. U.S. consumers and farmers have been absorbing most of the instability in the commercial food markets of the world.

All the other major agricultural export countries, including Canada, Australia, Argentina, and Brazil, maintain various kinds of governmental controls over exports. All export sales of grain by Canada, for example, are made through the Canadian Wheat Board, a quasi-governmental body established in 1935.

The European Economic Community has established internal price support policies for farm products and levies countervailing duties on imports equal to the difference between the world price and the internal support price. Another major importer, Japan, buys wheat and barley through a government food purchasing agency and closely supervises private imports of corn, grain sorghum, and soybeans. The U.S. S. R., China, and other Communist countries of course make all their import purchases through government agencies.

Thus the major food exporting and importing countries have policies to shield their farmers and consumers against extreme variations in prices. Without such stabilizing policies in this country, American producers and consumers are left to take much of the shock of changes in world supplies.

Projections by experts of the U.S. Department of Agriculture and of the U.N. Food and Agriculture Organization indicate that worId trade in grains will grow in the future. 'Demand for food in the developing Countries is likely to increase faster than production, requiring increased imports. USDA projections up to 1985 indicate that grain production in the developed countries will grow faster than demand, leaving a sufficient quantity available for export to less developed countries.

But there is likely to be considerable fluctuation "from year to year' in the total world grain supply. Since the United States is fully integrated into this world grain market (about 56 percent of the world trade in feed grains in recent years, 50 percent of the trade in soybeans and soybean products,. and 45 percent of the trade in wheat), it is essential that this country consider means of dealing with world instability.

The short world grain crops of 1972-73, intervention of the giant Communist countries into world markets for grain on a large scale, the sudden quadrupling of the price of imported oil and the incidence of famine, and near-famines in several countries have altered the world setting for U.S. food-agriculture policy.

Famines are not, unfortunately, uncommon to this earth; in fact, the latest ones are mild compared with many of the past. Nor is the finite character of fossil energy supplies, especially petroleum, something previously unknown; warnings have been sounded for decades by geologists.

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[1] Professor of agricultural economics, University of Minnesota.

[2] Writer-economist; chairman, National Planning Association Agriculture Committee, nnd member of the OTA Food Advisory Committee.

But the magnitude of recent changes in grain prices and world trade and the coincidence of these with the energy price hike delivered a shock to world consciousness about food. The steep rise of prices of basic foodstuffs in 1973 and 1974, along with the plight of undernourished people in Bangladesh and the Sahel region of Africa, gave common currency to the term "food crisis." Governments took stock of food prospects, and a World Food Conference to consider remeflial measures was held in Rome in late 1974 under sponsorship of the United Nations.

The food shortages in the early 70's have revived long-range fears of population outrunning food production capacity in the world. These fears had been quieted for several decades as food output per person gradually rose, and success stories about agricultural progress flourished in the less developed countries. New seed strains, more fertilizer, better irrigation, and new disease and insect controls, with technological help and capital from the wealthy countries promised steadily improving rations for hungry people in the future. Then the rapid disappearance of the large grain reserves carried for many years in the United States and Canada roused the old fears of gradually worsening food scarcity.

In this new atmosphere of panic, we often hear predictions of calamity and proposals for radical "solutions." For example, some prophets of disaster have proposed what they' call the "lifeboat" system of meeting the food problem. Only the most promising of the poor countries would be aided by the rich to seats in the lifeboat, abandoning the others to extinction by starvation, because there aren't enough seats in we boat for everybody. Another version of this idea is called "triage," a French army term for rescuing the wounded who have the best chance of survival, rather than using limited medical manpower in a futile effort to save all.

We reject such an apocalyptic view of the world food situation. We do not minimize the problem of the long run-of humankind increasing faster than the means of sustenance. But neither do we want to foster an attitude of hopelessness, such as the "lifeboat" concept implies. We believe wise policy and intelligent action can bring about a resumption of steady gains in food nutrients per person in the poor countries, gains which continued until the recent short harvests in several key production areas.

In the revival of ancient fears about the food-population equation, people tend to overlook another good-agriculture problem we regard as critical to food security. This is the problem of instability of supplies and consequently of prices. Some of the errors in food-agriculture policy have come from projecting short-term swings in supplies and prices. (The current doomsday predictions contain an element of this.)

In this respect, we want first to look at this nagging problem of instability. Let US assume that the real cost of producing grains and hence of food [3] will rise over the next quarter-century. We will have something to say about possibilities for changing this trend later, but for now let us project a gradual rise in the prices of grains for these reasons:

(1) The supply of new conventional productive resources-land and water— as a source of increased food output will become scarcer as more of the easily developed land is developed.

(2). Energy resources will become scarcer, especially easy-to-use petroleum and natural gas.

(3) Weather conditions in the temperate zones best suited to cereal production may gradually worsen, as some climatologists believe, in the next quarter century.

(4) Population will continue to grow rapidly in the less developed areas of the world.

(5) Demand for grain for production of livestock products will continue to grow in the more highly developed, richer areas. The consumption of livestock products has been growing as economic development progresses and countries are willing to put more resources into agriculture to get more livestock products.

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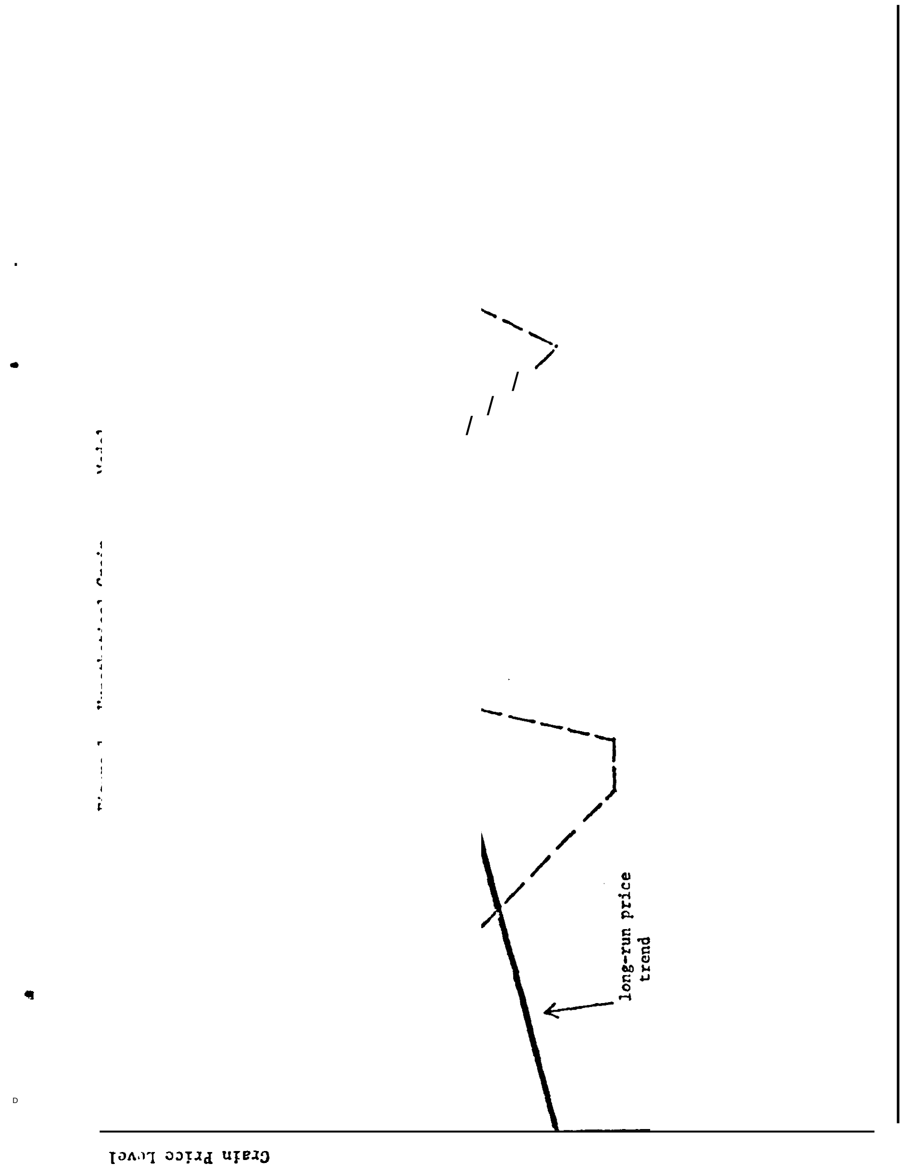
[3] Grains make up by all odds the most important direct food for mankind and are the raw material for much of the meat and other livestock products consumed as human food. Grains make up nearly SO percent of the crop acreage in America and are the balance wheel of the agricultural economy.


long-run price trend
Grain Price Level

THE PBICE INSTABILITY PROBLEM

U! this gradual upward trend occurs in prdces of food, due to slightly declining output per person, it certainly will not be a smooth configuration. Prices of cereal grains will fluctuate widely and unpredictably. We show this in a symbolic graph in Figure 1.

Instability of prices is likely to be a more serious problem in meeting the world food needs of the next quarter century than the trend of total food output.

The reasons we can predict instability with confidence are straightforward and indisputable.

(1) Demand for grains is highly inelastic small change in supply results in a big change in price. If the supply is short, people will bid up the price trying . to maintain their consumption, but if the supply is long, people will not increase consumption much, even at a low price.

(2) Production of grain is unstable and unpredictable because of unpredictable weather conditions.

(3) Demand for grain in international commerce is unpredictable and erratic, . because of policy changes in importing countries, primarily the state-trading countries. Here, for example, are the imports of grain into the Soviet Union in the last three years and the estimated total for 1975:

Tear:	Million metric tons
1972	20.8
1973	10.5
'1974	4.9
1975	25.0

This in-and-out buying on the world market jolts commodity distribution patterns and prices.

(4) Countries are closely linked in a network of grain trade today, where conditions in one importing or one exporting country are quickly reflected in prices the world around. The United States is the leading exporter, by far, and its markets are extremely sensitive to the factors" mentioned above.

(5) The prices of individual food products may be expected to zip and zoom in wider swings than the average price of all foods. Variation will depend on the lags in production of livestock products and the degree of substitutibility for some individual foods. Food-agriculture policies in different countries also vary for particular foods. On the whole, however, food prices for any country will not stray far from the general movement of prices (dashed line in Figure 1) unless that country is willing to isolate itself from the world trading system.

To sum up, the United States is confronted with a critical problem of instability in food and agriculture in the next quarter century. The forces causing this instability arise in large measure outside this country.

Consumer groups and humanitarians who have been focusing on the perils of long-term growth of world population in relation to food output would be wise to look more closely at the consequence of year-to-year changes in supply and demand. Fluctuations such as those of the 1972-75 period harm consumers by . causing extreme advances in food prices which tend to become anchored into the structure. Rigidities in costs of processing and distribution tend to keep retail prices from falling when supply increases as much as they rise in time of short supply.

Farmers and their organizations and U.S. Government policy have given relatively little attention to the stability' question. In most of the last forty years, the central issue for farmers was to maintain a high, profitable price level in a time of surplus production capacity. It is difficult for a farmer to see the advantages of stability or leveling out the peaks and valleys of prices. That process implies limits on the upswings of prices, as well as limits on the downswings. A farmer can readily see the benefits of the latter but does not like to face up to the economic and political necessity of the former.

Political realism, however, requires farmers to recognize that they cannot claim protection against disastrously low prices without also yielding to the claim of consumers for policies to protect against disastrously high prices. Obversely. consumers cannot claim protection against soaring food costs without also yielding to the claim of farmers for protection against damaging declines in their prices.

Although the U.S. has not developed a deliberate policy of food-agriculture supply and price stabilization, the functioning of price-support and commodity loan programs did, prior to 1972, provide a measure of such effect, as a by-product of other policy. Large accumulations of grain under government control in the late 1830's (called "burdensome surpluses") became valued reserves for the extra demands of World War II. Unquestionably, Americans had better diets and were able to supply their allies more fully because of this grain reserve.

Similar inadvertent reserve stocks were beneficial in maintaining reasonable food prices *in the 50's* and 60's Livestock producers *were* not faced with such sharp rises in feed coats as would have occurred without t.@ stockpiles of grain.

In 1972-73 and 1974-75, by contrast, we have seen financial crisis and violent disruption of the livestock Industries from short feed supplies and steep rises in feed costs, stemming from the combined effects of world drought Russian-Chinese imports and inflation Livestock price rises added to inflationary pressure on the entire economy.

In the light of this experience we recommend a national food-agriculture policy to deliberately stabilize the supplies and prices of ***grains.***

PRODUCTION TARGETS

We believe the place to begin is to set production, target each year for the leading agricultural commodities. Under the Agriculture and Consumer Protection Act of 1973, the U.S. Secretary of Agriculture is required, in effect, to make such calculations in determining whether to establish crop acreage and if so, how much. So what we are calling for here is not a new planning system but the effective employment of a system now on the lawbooks.

The target for each commodity would be constructed from five components : (1) Domestic commercial requirments; ***(2) Domestic food*** assistance requirements; (3) Commercial export demand; (4) Non-commercial exports; that is, a food-aid commitment for poor countries; and (5) A requirement to replenishh the U.S. share of an international grain reserve.

In order to make the best possible estimates of these aggregates, the Department of Agriculture needs the best possible political and economic intelligence about world supply and demand. The U.S. Government ought to take the leadership in helping to improve crop and livestock reporting services for other countries, the United Nations Food and Agriculture Organisation, and the new World Food Council.

The least predictable element in the above list of five production requirements is No. 3, the estimate of commercial exports. International cooperation in scheduling grain exports and imports, better crop estimating in major producing countries, and forward contracting for grain by importers would help stabilize this element of total demand.

The United States and the Soviet Union have an agreement to exchange agricultural data, but it has not been carried out as well as it might be. We urge the U.S. Government to press for full cooperation in the furnishing of information on production, rise, and stockpiling of food commodities, especially grain. Investment by the United States in improving the fundamental data base both home and abroad for projecting commodity requirements would pay a high return in terms of reducing surprise, uncertainty, and speculative price gyrations.

We believe that establishment of national production targets or goals each year would provide improved guides for individual farmers in planning their own operations. It would formalize a public commitment on the part of the U.S. Government as to the food needs of consumers and other claimants to America's agricultural abundance.

Setting production targets--and going through the process of collecting information and analyzing it in the public arena--is in itself a valuable contribution to wiser matching of output and needs. But to be most effective the Government must back up production targets by realistic incentives for producers. And Government must, of course, carry out objectives in food aid at home and abroad and in the acquiring and distributing of grain reserves.

Government programs already exist for purchase of commodities to supply food aid and to build reserves. (Later in this paper we propose improvements in these mechanisms.) We emphasize that these programs should be used on a planned, rational basis, with understood procedures and upper and lower limits for executive action.

Although the experience of the last few years would seem to rule out a return to crop acreage adjustment as a backstop to supply stabilization, a longer view indicates that such programs may be needed when there is a probability of price depressing surpluses. We believe the cropland set-aside system now in the law is the most workable method. But the bases for these set-asides could be and should be improved. The historical base system would produce wide inequities among farmers if set-asides were reinstated. We recommend a revision of bases on a formula of resource conservation. Now is an excellent time to set about this reformulation, in a period of full production and non-use of incentives to reduce output.

The Government ought to be prepared to' assure farmers needed inputs, at subsidized prices if necessary, for commodities for which an expansion of output is sought. This is being done from time to time, with regard to propane for example, and could become essential in other respects as the energy problem becomes more acute.

Incentive prduction payments may needed at times to reinforce the market in inducing expansion of output in needed communities. In the main, however, we believe a vigorous program of outlook and production information for farmers can be relied upon for serving such objectives.

It will be noted that we do not mention price-supporting action by Government as a tool for helping achieve production goals. Our overall policy seeks to stabilize prices-that is, reduce fluctuations--and we believe it would be contradictory to intervene in markets in another context. (More about this later.)

STABILIZING WORLD GRAIN PRICES IN THE SHORT RUN

We turn now to a proposal for moderating the fluctuations in world grain prices, the disrupting effects of which have been harmful to both consumers and producers in the early 70's. This is the heart of our food-agriculture policy for the United States:

World society must have a planned reserve stock program for grains to hold market prices within a price stabilization range:

(1) Governments should stand ready to acquire (or assure the holding by private individuals and firms) of stocks at the lower boundary of the price range;

(2) They should stand ready to release stocks at the upper boundary of the price range; and, as a result;

(3) Even out supplies flowing into markets over time, holding prices within the bounded price range.

OPERATING A GRAIN RESERVE PROGRAM

The grain reserve program might be operated by the United States alone, by a United Nations agency alone, or by a group of countries under an international agreement.

As we have mentioned, the United States did, for all practical purposes, operate a world grain stock program by itself for many years. Canada was an involuntary participant part of the time.[a] The stocks were accumulated under the farm price support program and released when world demand sent prices soaring. The cost of this operation, which was of considerable benefit to the world, especially the less developed countries such as India, was borne by the American

. . . "

There are advantages and disadvantages to each of the three organizational forms we have suggested. The U.S. handling the program alone, as the biggest - single producer and exporter, could probably do the most effective job. But the cost would. be on one country. The United Nations system is the most logical from the viewpoint of world politics and of sharing the cost equitably. Ultimately, we would hope this could be the way to run a grain supply stabilization plan. But there are obvious difficulties in administering such a program in the U.N. today, with its antagonisms and consequent incapacity to make decisions on rational economic grounds.

We. conclude that the most practioal system at this time is an organization with a small group of countries (say the U. S., Japan, Britain Germany, Canada, and one or two others). Such a group, we feel could work together effectively.

World grain prices can be stabilised at plus or minus 10 percent of the trend, we believe, with 90 percent probability of' achieving this range, with an average grain reserve of 60 to 70 million tons. This is manageable; it is not more than the stocks held in *the* United States in the 1950's. Such a stock program, properly managed, would provide the mechanism for evening out supplies flowing into consumption and consequently prices for both consumers and producers. (See symbolic diagram; Figure 2.)

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[a] Canadian Wheat Board officials recently have expessed Interest in cooperation with the U.S. and Australia in managing the export trade and reserve stocks of grain. (See article by George Anthan, "Canada Eyes Cartel with U.S. on Grain," *Des Moines Sunday Register,* October 26, 1975.)

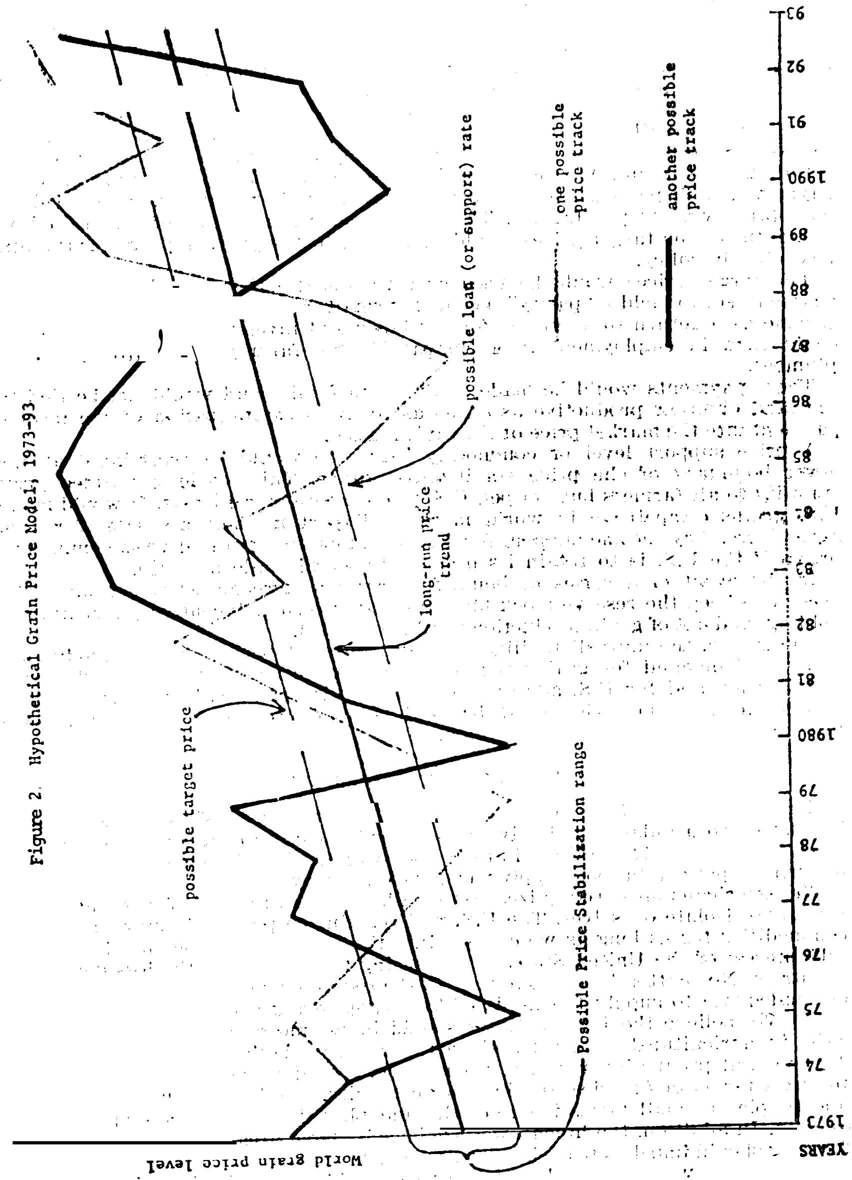

Figure 2. Hypothetical Grain Price Model, 1973-93

In operating the price stabilization program, we would let the price trend unfold itself through a moving three-year average of market prices. The price stabilization objective for, say, 1976, would be plus or minus 10 percent of the average of the last three years. Other methods of establishing abase for stabilization operations are, of course, possible, and the best guide would be several years of experience. But for a start, we think the Wee-year base would be best.

It is operationally feasible and, we believe, economically and socially desirable to link U.S. domestic farm stabilization and support programs to the international stabilization concept. We recommend a system of target prices and deficiency payments, with payment scaled so as to favor smaller farmers, with a ceiling on total payments per farmer. This is the basic framework of the 1973 law. Commitment on target prices would be limited to one year, to permit maximum flexibility in *policy.*

The target prices would be used only to compute the size of the deficiency payment set to yield a "parity" income for small farm families. We define parity income as a return to a farmer for his labor and investment equal to what he could earn in employment in a comparable non-farm job, for example as a plumber.

These payments would be made to the farm family and would not be tied to the land or other productive asset, so as to avoid capitalization of the income payment into the market price of the capital asset.

A price support level or commodity loan rate would be established at the lower boundary of the price stabilization range. This would guarantee price stability to all farmers but not peg U.S. prices above world levels. It would make U.S. grains competitive in world markets. Export **markets are vital** for U.S. agriculture. Any income support for farmers must be separated from commodity prices if the U.S. is to retain its position in world trade in grain.

In the event of a series of bountiful harvests, acreage set-asides might be needed to keep the reserve stock bins from overflowing. Incentive payments for holding land out of grain production would be needed.

To sum up, the unpredictability of short-run developments in crop production and world demand for grains requires this flexible machinery for world price stabilization and for U.S. adaptation to it. The international grain regime and U.S. national farm policy must be flexible, ready to adapt to famine, overproduction or other unforeseen developments.

LOOKING AT THE LONG BUN

Early in this report we expressed the view that the trend of world food supply in relation to population is likely to be toward scarcity in the next few decades. What policies should the United States follow in an effort to prevent such a trend or turn the per capita food supply trend the other way?

We Americans must recognize, first of all, that we are part of a world where we cannot isolate ourselves. The U.S. will remain the principal exporter of food commodities for as long as we can see into the future. This does not lessen the self-interest of the United States in increasing food output in the less developed countries. No matter how much U.S. food production might increase, it would - be inadequate to supply the needs of the fast-growing poor countries.

(1) We believe the United States should invest more money, public and private, in agricultural research and energy research both at home and abroad. Agricultural production research ***needs to be geared more to*** technology suited to small farms in America and in other countries. The low productivity of land and people on small farms is one of the unexploited sources of added food production. In addition, the human welfare benefits from greater emphasis on small farming should impel us to such a research orientation.

(2) It may well be sound economics to subsidize certain farm inputs, especially for small farmers, in order to maximize food output. Most of the technologies which have resulted in the remarkable increases in agricultural output per man and per acre in the last 30 years are adaptable to small farms as well as large--fertilizer, herbicides, pesticides, better seeds, irrigation. (There has been a lag in development of machinery suited to small farms, however.) Educational and financial help to small farmers to apply these improved technologies might be the investment with the highest payoff in greater food output at this time.

(3) We recommend the continuation and expansion of domestic food-aid programs, especially the Food Stamp Plan and the School Lunch Plan, to help assure the availability of good nutrition to all Americans.

(4) We endorse the confirmation of foreign aid to help those poor countries

willing to help themselves. The foreign aid effort of the U.S. should be directed increasingly through international agencies, as recommended by Secretary of State Henry Kissinger in his September address to the United Nations. As part of the U.S. foreign aid program, we favor continuation of food aid.

The limited resources available for foreign aid, including food, should be concentrated in areas where local self-help efforts make the aid most productive. We mean by this that effective agricultural development by the recipient country is essential, as well as effective population limitation programs, if American contributions are to be well used. We should consider limiting foreign aid to those less developed countries that undertake and sustain effective programs of agricultural development and population control.

(5) In the event of continued critically short food supplies, the United States might need to institute an event export control policy in its own and the world's interest. This would be a supplement to the international grain reserve we have recommended above. The policy might take the following form:

The U.S. would announce to the world its domestic requirements, the requirements of its regular foreign customers, and the necessary *reserve* allocation. It would then state that these supply requirements would be protected.

Periodically, perhaps every three months, the U.S. would report the drawdowns in supply and indicate the extent to which domestic requirements and those of regular foreign customers would be met without imposing export controls.

Foreign food aid for less developed countries on confessional terms would be adjusted to the situation, with guarantees for those countries dependent on the U.S.

Sales *of* grain to the state-trading countries would be negotiated by the U.S. Government, covering the total volume, range of prices, and other considerations. Actual sales and handling of the grain would be conducted by the private grain firms as before. But the U.S. Government would be in position to monitor and regulate the outflow consistent with other requirements.

If the world shortage continued and was of such extent that free exports from the U.S. would endanger the fulfillment of guarantees to American consumers and those countries long dependent upon us, the U.S. would impose export controls. This would be done after informing the world grain trade. Regular foreign purchasers would be exempt from the controls.

This, however, should be a policy of last resort in a critical world food situation.

If the above policies were carried out, we believe the swings in grain prices Would be substantially moderated and that the long-run trend toward food scarcity could be turned around.

It is most important that Congress and the Administration appraise the long-run food situation, make long-run policy commitments, and stick to them.

Many, perhaps most, of the policy changes recommended here could be accomplished under existing legislation, with minor alterations. However, a legal mandate and authority are needed if the U.S. is to help create and participate in an international grain reserve plan.

To carry out the proposals in this statement, a number of changes in government organization are needed, in our opinion.

The crises in food affairs in recent years have demonstrated in the iadequacy of information available to U.S. policy makers. The Congress and the executive branch have been caught short on knowledge about world supplies and prospective demands. The report of the Food Advisory Commitee of the Office of Technology Assessment and testimony by a number of witnesses in earlier hearings on food information systems have clearly shown the gaps in information and the lack of adequate analysis of the facts available.

The responsibility for world food information in the U.S. Department of Agriculture is now split among three agencies: the Economic Research Service, the Foreign Agricultural Service, and the Statistical Reporting Service. There is a confusion of functions in this setup and a potential conflict of interest that may contaminate the quality of the information and analysis.

The FAS has a primary responsibility to expand foreign markets for U.S. farm products. This makes suspect the assessments of world commodity situations and outlook prepared by the Foreign Commodity Analysis Unit of FAS. One way to overcome this apparent conflict of interest would be to transfer this analysis unit to the ERS. Commodity specialists in ERS already perform much of the same kind of analysis of foreign commodity situations. It is logical to combine the two staffs and to place them under ERS, which has no "action" responsibility. Its duty is to provide economic intelligence for *users* of its reports and for government policy makers.

FAS also has a responsibility to collect facts and collate information about world food and agriculture conditions. To achieve the maximum objectivity, it would be desirable to separate this fact-gathering function from the sales promotion agency and to assign it to SRS, which has the sole function of preparing factual reports on agricultural data. However, the responsibility for collecting foreign agricultural data necessarily must remain with the agricultural attaches under FAS until such time as specialists in crop and livestock reporting can replace them.

The Food Advisory Committee and others who have examined the world food information problem agree that better analysis of available data is needed. We believe the logical agency in which to center responsibility for this function is IRS and that it should be provided funds to increase its staff for this purpose.

In general, the important statistical and analytical services in USDA have been neglected compared with other services. It is true, we believe, as is often claimed, that these services in SRS and ERS are the best of their kind in the world and the most objective and reliable. Nevertheless, the vital importance of a world food intelligence system for this country and for the world makes it essential that these services be improved as much as possible.

It has been suggested that a separate world food intelligence agency be established, separate from the USDA Outlook and Situation Board. This is a reasonable proposal, but we believe improving the present Board's operation and strengthening ERS and SRS would accomplish the same result and should be tried first.

The Interagency Commodity Estimates Committees now are responsible for developing supply-demand estimates used by the ERS Outlook and Situation Board. The ICEC is chaired by an official of the Agricultural Stabilization and Conservation Service, an action agency. Here, as in the case of FAS, there is a potential conflict of interest, in appearance if not in fact. We find this undesirable and a handicap to achieving the most objective food situation analysis.

We agree with Howard J. Hjort, who testified before this committee on September 24, that the chairmanship of the ICEC should be removed from ASCS. Further, responsibility for foreign trade estimates should be removed from FAS and representation of that agency on the supply-demand estimates committees should be removed.

With these alterations, and additions to staff, ERS and its Outlook and Situation Board could perform more reliably as a world food intelligence unit.

[The following questions were submitted by Senator Humphrey to Mr. Seth and his answers thereto:]

Question 1. If I understand your paper, you indicate a reserve stock program, accumulating stocks when prices fall 10 percent below the three year world average and releasing them when prices rise 10 percent above this average, would contain the market fluctuations within these limits in 9 years out of 10. Is this a correct reading of your paper? How confident are you of these frequencies, in view of our recent experience?

Answer 1. The calculations on the amount of stocks needed to stabilize grain prices within a range 10 percent above and 10 percent below a three-year average are based, necessarily, *on* the experience of recent decades. In the perspective of the whole century since 1875, the last three decades have been a period of remarkably stable temperature and rainfall in the major grain-producing areas. There is some reason to believe, according to Louis Thompson of Iowa State University, that weather will be less favorable in the next quarter century. If this occurs, the instability of production in the early '70s may continue. Then our estimate of the steps needed to stabilize prices would require modification.

Question 2. Would you place any limit on the physical size of the stocks, or would you accumulate stocks as long as the market price remained below the announced stabilization level?

Answer 2. I would not place any arbitrary limit on size of stocks. However, if a series of big crops resulted in a situation comparable to that of the 1950s, then the acreage-adjustment features of the 1973 farm act should be brought into play. We recommended a revision of the acreage bases to make this program feasible if the "surplus" circumstances should arise.

Question 3. How would you have the Government and the producers share in holding the reserve stocks?

Answer 3. The Government needs sufficient stocks to meet its responsibilities quickly in any international reserve plan. Beyond this, maximum storage on farms, with storage payments to farmers, is desirable, especially in the case of feed grains. The practical working out of a storage program could guide the ratio of government to farmer stockholding. The main thing is to have an overall target for the reserve program and to see that it is reached, totaling government, commercial and on-farm storage.

Question .4. If stocks are acquired in excess of some agreed minimum desirab1e level, would you release the excess before market prices reach the upper stabilization level?

Answer 4. No. Stocks should not be released until the upper price limit is reached-and in certain circumstances perhaps not then. This range of stabilization is not always likely to be the perfect range. In at least one out of 10, we figured, the ranges might be exceeded. However, the problem is likely to be ***to*** maintain sufficient stocks-not the problem of surplus and over-accumulation.

Question 5. What is the merit of continuing target prices and deficiency payments, if price supports are maintained at 90 percent of the three year average world price level (or some similar level) ?

Answer 5. Target prices and deficiency payments should be continued in the law for possible use whenever prices to producers sink below a "parity" level. Our plan is for stabilization around a long-time trend, with no income-support for farmers. But it is possible that another series of good crops could lower income to the point where some income protection would be needed. In that situation, we prefer the payment system to price support. The payments should be the means of providing farmers with some guarantee in return for a full production program. Price supports above a long-term trend would handicap the United States in foreign trade.

Question 6. We have resorted to voluntary export controls several times in the last 3 years. You expect the world food supply per capita to trend down rather than up in the next 25 years. In view of both recent experience and this outlook, is existing statutory export control authority adequate?

Answer 6. Existing export control legislation seems adequate. It should be resorted to, as **we said** in our paper, only in extreme circumstances. Normally, Cochrane and I would expect that "export control" would be achieved by the managing of the reserve stockpile. That is, the government by its buying and commodity loan policies would assure that sufficient reserves were maintained to fulfill our international commitments and to meet stabilization requirements.

Question 7. If it is not adequate, how should it be modified?

Answer 7. See answer to 6.

Question 8. What Government agency should have the responsibility for administering food export controls?

Answer. 8. The Commodity Credit Corp. or other agency assigned responsibility for managing the U.S. grain supplies.

Question 9. You ***seem to*** advocate combining aspects of a welfare program with aspects of a commercial agriculture policy (page 198 and again on page 200). Why not restrict policy in agriculture to commercial agriculture policy and let welfare programs be labeled as such?

Answer 9. If the United Stakes wants to maintain a healthy rural economy, and the Rural Development Act indicates that it does, then some measures need to be taken to preserve family-type farm operations. "Loading" any deficiency payment plan slightly in favor of smaller or intermediate-size farmers would be one way of doing this. It would remove some of the advantage that large-scale firm operations now have. Favoring the family farm in farm income support programs has long been conventional doctrine-in rhetoric. But Cochrane and I believe firmer action is needed to stop the trend toward industrialized farming. Welfare programs, such as food stamps, should be 1abeled as such, but we are talking here about income protection for commercial farmers.

Question 10. Page 200, paragraphs (1) and (2) : These points seem to contradict. In paragraph (1) you say we need technology oriented to small farms; in paragraph (2) you say ***most*** technology developed is equally advantageous to any size farm ! Which is correct?

Answer 10. It is true that the major advances in farm technology. fertilizer, seeds. chemicals, are equally adaptable to small and 1arge farms. But, as we mentioned, machinery development has favored large farms and little effort has been made to improve machinery for small farms. Methods of using new technology have not been well adapted to small farms, and maybe this is a matter of education or extension as much as of research. What is needed is social science research **to enable** the farm technology revolution to become effective on Small firms especially in less-developed countries.

[The following questions were submitted by Senator Humphrey to Dr. Cochrane an answers thereto:]

Question 1. If I understand your paper, you indicate a reserve stock program accumulating stocks. When priced fall 10 percent below the 3-year world average and releasing them when prices rise 10 percent above this average, would contain the market fluctuations within these limits in 9 years out of 10.

Is this a correct reading of your paper?

How confident are you of these frequencies, in view of our recent experience?

Answer 1. Your reading of our proposed reserve stock program is correct. With a stabilization price range of plus or minus 10 percent of the S-year moving average, we argue that worldwide market price fluctuations would be contained within that range 9 years out of 10, with one qualification. This probability holds only after the program has been in operation a few years and the reserve stock has been built up to the average of 60 to 70 million tons.

You ask how confident are we of these frequencies. If the long-run trend price of grain turns out to be flat and the 3-year moving average trends neither upward or downward, I would be most confident of the probability of containing worldwide market price fluctuations in the grains within limits of plus or minus 10 percent, 9 years out of 10. But if the long-run trend in grain prices is upward, reserve stocks would be persistently pulled down and the program would lack the capacity to contain upward market fluctuations. If, on the other hand, the long-run trend in grain prices is downward, reserve stocks could accumulate persistently and become greatly in excess of stabilization needs and hence require some means of curtailing the continuous inflow of stocks. To keep the 3-year moving average of prices from declining steadily and the reserve stock bins from overflowing, the nations party to the international grain reserve stock program would need to adopt effective production controls for the grains. Long-run upward or downward trends in world grain prices would, without doubt, complicate the effective operation of an international reserve stock program for the grains.

Question 2. Would you place any limit on the physical size of the stocks, or would you accumulate stocks as long as the market price remained below the announced stabilization level ?

Answer 2. As I intimated in my reply to Question 1, if the long-run trend in world grain prices is downward, it would become necessary to find a means of reducing the inflow of stocks. But the answer could not be a limitation on the acquisition of stocks; such a limitation would break the stabilization program by letting market prices fall below the lower boundady of the stabilization range. Continuous overproduction and a long-term downward trend in world grain prices would need to be corrected by production controls in the commercial exporting nation. However, it should be recognized that the downward movement in the 3-year moving average of world market prices would itself moderate the problem of accumulating reserve stocks greatly in excess of stabilization needs. Thus, I ***would certainly not advocate the*** establishment of a physical stocks ***limitation in the beginning years of the*** stabilization ***program.*** If long-run grain price trends in the 1970's and 80's are reasonably flat, we may expect the reserve stocks accumulated and held under the 10 percent decision rule to average 60 to 70 million tons. Given this general world supply, and demand situation, the program itself will generate the desired quantity of reserve stocks. If the general world supply and demand conditions generate either long-term upward or downward grain price trends, then we would need to experiment with export policies and input subsidies on one hand or production controls on the other—hut ***not physical limitations on stock acquisitions.***

Questions 3. How would you have the Government and the producers share in holding the reserve stocks?

Answer 3. I have not given a great amount of thought to the question posed under number 3, but for starters I would suggest that the government and producers share the holding of the United States portion of the international reserve on a 50-50 basis above some minimum amount which the government must hold at all times, if it is able. The United States government must have stocks which it can release quickly and readily at all times; thus I suggest that government hold some minimum amount of the U.S. stock, plus 50 percent of the amount above that minimum. But contracts with producers would also need to be flexible. Contracts with producers would have to contain a clause in which the government could obtain the stocks held by producers with, say, one-month's notice. Such a provision would be necessary in contracts with producers in order to replenish the government stock, as it released stocks into the market. I am sure that arrangements could be worked out wherein producers held an important part of the reserve stock provided the storage contracts with producers could be terminated within a reasonable time, say one month, if and when the government stocks become too low to enable the United States government to fulfill its commitment to the international reserve stock program.

Question 4. If stocks are acquired in excess of some agreed minimum desirable level would you release the excess before market prices reach the upper stabilization level?

Answer 4. Stocks should never be released except in response to the established decision rule for releasing stocks. The decision rule might say that some stocks will be released before market prices reach the upper limit of the stabilization range. But such a formula for releasing stocks before the market prices reach the upper boundary of the stabilization range would need to be defined precisely and known to all. Stocks should never be released in response to their accumulation to some excessive quantity; if stocks were so released, confidence in the stabilization program would quickly erode. Excessive stocks might call for production control on the part of the nations party to the #stabilization agreement but not for the arbitrary imposition of a limitation to the accumulation of stocks.

Question 6. What is the merit of continuing target prices and deficiency payments, if price supports are maintained at 90 percent of the three year average world price level (or some similar level) ?

Answer 5. As a part of our internal agricultural policy, the United States might wish to continue a system of target prices and deficiency payments to protect the incomes of small and medium sized farmers where the 8-year moving average of world prices is declining persistently and significantly. Internal price supports at 90 percent of the 3-year moving average would provide price stability and price certainty to producers in their production planning. But it would not guarantee producers a fair income, Thus, to repeat, we might as a matter of national policy wish to make deficiency payments to small and medium sized family farmers to support and enhance their income.

Question 6. We have restorted to voluntary export controls several times in the last 3 years. You expect the world food supply per capita to trend down rather than up in the next 25 years. In view of both recent experience and this outlook, is existing statutory export control authority adequate?

Answer 6. If the world per capita food supply trends downward over the next 25 years and the real price of food trends upward, it may well be necessary for the United States to have an export policy to protect its consumers in years when market prices are not contained within the stabilization range by the stabilization program. I am not sure whether existing statutory export control is adequate, since I don't know its exact provisions, but I would doubt that it is. Seth and I outline in our paper what we deem to be a desirable export policy on page 201 of our paper. This policy we believe should be enacted into law. If the international reserve stock program for the grains is operating satisfactorily, the control features of the export policy outlined on page 201 would not become operative. But in years in which world supplies were exceedingly short and world market prices were not contained within the stabilization range, the control features of the policy outlined on page 201 would become operative. And to become operative in such years, it should be placed on the legislative books now or in the immediate future.

Question 7. If it is not adequate, how should it be modified?

Answer 7. I have already answered this question in my answer to Question 6.

Question 8. What Government agency should have the responsibility for administering food export controls?

Answer 8. In my judgment the present United States Department of Agriculture should be expanded and restructured with three principal missions: (1) the provision and distribution of adequate food supplies to all persons in the United States; (2) the promotion of a prosperous, productive, commercial agriculture; and (3) the promotion of rural development and a high quality of living in rural areas. The administration of the food export policy described under Question 6 would logically fall under the first mission of this expanded and restructured Department of Food, Agriculture, and Rural Welfare.

Question 9. You seem to advocate combining aspects of a welfare program with aspects of a commercial agricultural policy (page 198 and again on page 200). Why not restrict policy in agriculture to commercial agriculture policy and let welfare programs be labeled as such?

Answer 9. We are not talking about social welfare as it is usually viewed in the United States on page 198 of our paper. In the first paragraph of page 200, we are talking about a system of deficiency payments, or income supplements, to small and medium sized commercial farmers to help those farmers achieve a parity of income. We are talking about an income policy for small and medium sized commercial farmers in paragraph. 1 of page 200, not a welfare program as welfare programs are typically construed in the United States.

Question 10. Page 200, paragraphs (1) and (2). These points seem to contradict. In paragraph (1) you say we need technology oriented to small farms; in paragraph (2) you say most technology developed is equally advantageous to any size farm ! Which is correct.

Answer 10. The points noted by your office with respect" to our paper on page 200 are somewhat contradictory. Let me make the following comments with respect to technology and small farms: (1) Biological technologies as they have been developed in the United States over the past 30 years are usually neutral with regard to size of farm; in a technical sense, small farmers can use hybrid seed corn as effectively as large farmers. (2) The development of farm machinery in the United States, in my judgment, has been large-farm oriented and has contributed to the expansion in the size of farms in the United States. It is my view that an effort should be made to induce farm machinery manufacturers to develop machinery which is more adapted to the needs of small farms than existing lines of machinery. In my judgment a great deal could be achieved in the way of developing mechanical equipment oriented toward the needs of small farms and small farmers if we had a policy designed to bring about this development. (3) Small farmers are often in need of technical assistance both with, regard to biological technologies and mechanical technologies to enable them to remain efficient and survive. In the main, we in the United States have failed to provide the extra amount of technical assistance required by small farmers This failure could and should be remedied by the Congress.

Chairman HUMPHREY. Dr. Tweeten, we will hear from you next and then will follow the procedure that the Congressman indicated.

STATEMENT OF LUTHER TWEETEN, PROFESSOR OF AGRICULTURAL ECONOMICS, OKLAHOMA STATE UNIVERSITY, STILL WATER, OKLA.

Dr. TWEETEN. Thank you, Congressman Brown and Senator Humphrey. My presentation is divided into two principal sections; one deals with the future supply-demand prospects for agricultural commodities, and the second deals with policies appropriate to the situation emerging in the next decade.

It has been my good fortune to spend approximately 3 months looking at the long-term outlook for agricultural supply and demand in the world. I have gone to some of the best experts in the various areas to t the latest information available.

I have supplemented this information with my own judgment.

It is very important, in the context of the previous presentations, to separate need from effective demand. In discussing what will happen to U.S. exports, I am talking about effective demand rather than need.

The need for food is vast, but from the standpoint of prices to the domestic consumer and the farmer, it is effective demand that is important. My best estimate of the average increase in effective demand for U.S. farm commodities through 1985 is about 1.5 percent a -year.

My estimates of supply are based on very exhaustive studies of technology in American agriculture. Productivity of agriculture increased at the rate of over 2 percent Per year in the 1950. That has slowed considerably. Productivity, I project, will increase *a* little over 1 percent a year to 1985. Alternate projections are also included. The highest projection, 2.1 percent a year, includes unprecedented technologies that are on the horizon. These include twinning in cattle, bioregulators and photosynthesis enhancement.

The best estimate is that demand will increase faster than productivity will increase supply.

This is good news for #arm income, but bad news for consumers. Unfortunately for farmers, inflation is going to consume gains in prices received so that the ratio of prices received to prices paid is going to hold roughly steady according to best estimates for 1985.

Current dollar net farm income will rise substantially to 1985, but real dollar income, or buying power, will decline.

The two principal problems facing farmers in the next decade are instability and inflation.

My paper deals at considerable length with how to cope with instability. The first priority is to build commodity stocks. Either Government or the private trade can do it. The rise of the consumer as an important participant in national food policy precludes the private trade holding adequate stocks. The risks are too great.

The private trade holds stock when anticipated prices increases will cover their costs. When these price rises are in danger of being truncated by capricious consumer action, the private trade will not hold adequate stocks. So that turns us to the Government.

Current loan rates do not reflect the social value of accumulating stocks.

Chairman HUMPHREY. I was at the Committee on Agriculture and Forestry hearing this morning talking to Mr. Knebel, the newly appointed Under Secretary of Agriculture, on this very point.

Dr. TWEETEN. Senator Humphrey, if current loan rates continue, the Nation may dissipate the opportunity to accumulate stocks. Potential stocks will instead be exported, fed to livestock, or not be produced because of cutbacks by farmers to low prices. My suggestion is that loan rates be raised at least to nonland cost of production.

Farmers now are opposed to participation in this program. They properly see that in the past high stocks were associated with low prices. Some inducement is needed to get the farmer to go along. I suggest that we encourage the farmer to store commodities paying him 25 to 35 cents a bushel per year to store grain. As a condition for payment, the farmer would agree not to release those stocks at less than 150 percent of the loan rate.

This procedure would require the private trade to carry working stocks because farmer held stocks receiving payment would not be released until price gets to 150 percent of the loan rate. Private storage would hold down Government cost.

Once stocks accumulate to optimal levels, which I place at about 45 million tons of feed grain, 600 million bushels of wheat, and 150 million bushels of soybeans, then farmers would not receive payment for additional stocks. If they wanted to hold them, that is fine.

Once stocks reach desirable levels (here I refer to desirable stocks on the average for a period of years; stocks might be higher or lower in some years), then I suggest forsaking production controls. Controls are increasingly less tolerable in an atmosphere where the consumer is a rising influence in farm policy, where we realize that production controls have not been very effective in the past and have been very extensive.

The market price might be allowed to fall without any overt effort on the part of the Government to accumulate additional stocks. A direct payment be made to farmers equal to the shortfall of the market price below the nonland cost of reduction support rata.

A payment limitation would restrain growth of large corporate type farms and would preserve family-sized farms.

Furthermore, I would make this direct payment on normal yields times 80 percent of acreage allotment tied to 1973-75 acreage. The old allotment system is obsolete.

The farmer receives the market price for his additional output. This would have a strong restraining influence on output. The overall plan gives farmers flexibility to make proper adjustments in how much output to produce; and at the same time provies for adequate stocks. The plan can promote stability for consumers as well as for farmers.

Inflation has often been overlooked as a very serious problem for farmers. Inflation has been masked in recent years because the farming industry has experienced a very favorable demand for output. Undesirable effects of inflation will become more apparent in the years to come.

How do we protect farmers against this?

In the paper which you perhaps have before you, one of the suggestions I have is that we institute a wage supplement.

Chairman HUMPHREY.. I saw your proposal.

Dr. TWEETEN. I think some of you are familiar with that concept.

In the interest of brevity I will not go into it in detail unless people have questions about it.

Thank you very much.

Chairman HUMPHREY. Thank you.

Let me pose a general question. I am chairman of the Foreign Agriculture Subcommittee, chairman of the Foreign Assistance and International Economic Policy Subcommittee of Foreign Relations Committee, and chairman of the Joint Economic Committee. All my activities are in this field.

I want to ask you gentlemen if you would be willing to make yourselves available for presentations to these other subcommittees and especially the Joint Economic Committee,

I say the latter because I think, Dr. Cochrane, you were right that our planning bill did not give the specific emphasis that might be necessary for agriculture.

I held Joint Economic Committee hearings for the first time since 1957 in which any person with agricultural expertise appeared

In addition, the Senate Committee on Agriculture and Forestry does not in any way tune itself in to what is happening in the rest of the economy. I listened to what you said regarding the rising power of the consumer. We are attemptmg to stonewall that, you see, as if you could prevent it. It is like old King Knute holding back the tides. Temporarily? you are able to do it, off and on, by bringing together certain coalitions in the Congress. But the long term is another issue. I do not know how to explain it to you except to say that if you look around this room, there are some very interesting people here. But the press table is empty.

Now, why do I tell you that? Unless there is an investigation of the grain shipment or export scandal, there is no press. Seldom any media. I can tell you I have been on the committee for 18 years. The only time we have any media coverage is when we have a first-class knockdown dragout fight with the Secretary of Agriculture.

Yet, I think it is fair to say that what you gentlemen have been discussing is more basic to the long-term economic well being of the United States and the world than the oil crisis. People can get along with less oil, but there is no substitute for food. Yet this is a subject matter that only is peripheral in terms of its national interest. When an issue is internationalized then you attract some media attention.

You hear about farm prices, but no one hears about inflation as it affects the farmer.

We had before the Joint Economic Committee every one of the pub. lic opinion institutes of this country. We use them regularly: Cadell, Hart, Roper, Gallup, Harris, Michigan, public opinion surveys. They found that people identify inflation as the following:

No. 1, food prices; No. 2, fuel; No. 3, rent; and No. 4, interest.

Inflation was identified as food 68 percent—running between 65 and 72 percent—of the time in every survey. In other words, as far as Mr. and Mrs. America are concerned, inflation is the price that they pay in the supermarket.

You can raise the rice of a quart of milk a penny, and you will have a veritable revolution. You can raise the price of a glass **of** beer a nickel and no one notices.

The only thing people complain about is whether Coors is as good as Olympia, Hamms, or Budweiser.

Dr. Tweeten?

Dr. *Tweeten.* Looking at parity ratio, the figure for November 1973, based on 1910-14 equal to 100. That is below the same parity ratio in the 1960's and early 1970's, and still I think a lot of consumers are saying, "Aren't food prices high because farmers are getting too much ?"

Chairman HUMPHREY. No doubt about it.

And concern about food prices is the same in Minnesota. Even though agriculture is the industry in my State, you would never know it by reading the local paper.

Mr. Soth. You should read the Des Moines Register.

Chairman HUMPHREY. I know it.

May I say I wish we had it. I say this respectfully, because I happen to think we have a good newspaper, but the emphasis is not the same. If 5,000 people were laid off at Honeywell in Minneapolis-St. Paul, every economist at the university, every preacher, every social worker, every do-gooder, every liberal, would be up in arms saying something has got to be done about it. But we've lost 5,200 diary farmers in the last ***2 years*** and no one said anything. These farmers not only lost their jobs, but they lost their assets, too.

[The following paper was requested by OTA from Dr. Tweeten:]

FORMULATING A NATIONAL FOOD POLICY FOR THE NEXT DECADE

(By Luther Tweeten)*

Formulating a national food policy for the next decade requires an understanding of (1) the setting including trends in supply, demand, prices and incomes and (2) alternative policies to deal with emerging problems consistent with the interests of farmers, taxpayers and consumers at home and abroad.

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*Regents Professor, Department of Agricultural Economics, Oklahoma State University, Stillwater. Professional Paper P-248 of the Oklahoma Agricultural Experiment Station, prepared *for the* Office of Technology Assessment. Comments *of* Daryll Ray, Milton Ericksen and Walter Wilcox were very helpful. The author retains sole responsibility for shortcomings of this paper.

This paper begins with economic projections of the farming economy to 1985. The paper then examines policies, institutions and data requirement to cope with emerging, circumstances.

THE ECONOMIC SETTING TO 1985

Scenarios define the conditions under which supply, demand, prices, costs, receipts and net farm income are projected to 1985. The scenarios depict the range of conditions judged most probable. It is cautioned that the projections do not encompass transitory shocks such as annual variation in grain purchases for export to the Soviet Union, weather, commodity stock adjustments and other factors which will bear heavily on short-run conditions but not on long-run . trends. Critical components discussed below of the scenarios are demand shifters (population, income and exports) and supply shifters (productivit, inflation)

Supply

Supply cab be expressed with two principal parameters: shifters and price elasticites. The SIMPASS agricultutal projections system devised by Quance and Tweeten (1972) and improved by Chung J. Yeh of the Economic Research Service performed well in predicting the 1967-74 period with aggregate supply elasticities of .2 in the short-run (l-2 years) and 1.0 in the long run (many years). These parameters are consistent with past econometric estimates (Tewee-en) Qquance, 1969, ajusted for the increasing short-run elasticity caused by rising propoertions of price responsive inputs such as fertilizer and falling proportions of price-unresponsive inputs such as operator and family labor. The supply curve is shifted leftward by inflation and rightward by technology through greater productivity of arming resources.

Productivity.— The productivity index is *the ratio* of aggregate output of the farming industry to aggregate production inputs. The most recent and comprehensive analysis of agricultural productivity response to research (R) and extension (E) outlays was, performed by Lu and Cline (1975]. Additional agricultural extension and research outlays raise the amount of farm output available from any given amount of far production inputs. Effects of increasing R and E are not immediately apparent but are spread over many years. The farm outputs from public R and E outlays in any given year reach a peak at 6 years and decline to near zero in 13 years because of obsolescence of technol*ogy-an* effect often ignored in payoffs ***from*** such outlays. Depreciation ***or*** obsolescence sets in as new crop varieties become vulnerable to damage from pests, as insects become immune to pesticides and as new technologies make old technologies obsolete. This means that substantial R and E maintenance outlays are necessary just to keep farm productivity from falling. An additional dollar spent on production-oriented R and E raises agricultural output approximately $4.30. Since the increments In output are. distributed over time, they must be discounted to exrpess them in present value. The present value of a one dollar investment in R and E expenditures for a 10 percent discount rate ***was*** found by Lu and Cline to be $2.21.

The internal rate of return is that discount rate which equates the stream of the future marginal products with the initial investment of one dollar. The internal rate of return shows the highest interest rate that coul d be paid on investment in public R and E to just break even on the investment. The internal rate of return based on national data from 1939 to 1972 is approximately 26.5 percent. This rate has declined over time: it was 30.5 percent from 1939 to ,1948, 27.5 percent from 1949 to 1958, 25.5 percent from 1959 to 1969 and 23.5 percent from 1969 to 1972. The rate of return in the most recent period remains substantially above returns on the average of alternative public and private investments and public R and E contributes to a more equitable distribution of income (Tweeten, 1973). Strong justification can be made for increasing investment in R and E.

A one percent increase in R and E will, over its lifetime, bring about a .037 percent increase in productivity. The increase is small despite highly favorable rates of return because public R and E comprises less than 2 percent of all farm inputs. Using estimates from Lu and Cline, three alternative levels of R and E expenditures and resulting changes in productivity for the 1975-85 period are considered in this study:

T.: Maintain a zero rate of growth in R and E expenditures, holding real outlays for extension and public research at the 1974 dollar value—increments in dollar outlays only keep up with inflation. This leads to a 1.10 percent annual growth in productivity of conventional farming inputs for 1975-85.

T_3: Continue the observed rate of real growth in R and E during the 1939-72 period, 3 percent per year. This leads to a 1.14 percent annual growth in farming productivity in the 1975-85 period.

T_4: Continue the average rate of real growth in R and E ***during*** the M144-50 period, 7 percent per year; also include productivity gains from unprecedented technologies. This leads to a 1.21 percent annual growth in farming productivity in the 1975-85 period.

The above percentage rates refer to real (constant) dollar increments from a 1974 base. If inflation averages 4 percent per year, then the current dollar increments for the respective alternatives are T_0, 4 percent; T_3 7 percent and T7+ 11 percent. Unprecedented technologies include breakthroughs which are likely to occur at specific times as judged by agricultural scientists but are not included in conventional productivity indices. Technology index T7+ includes effects of three such technologies: Twinning in cattle, bioregulators, and photosyntheses enhancement. Other practices such as minimum tillage are not explicitly included but also offer potential for greater output from a given dollar volume of production resources. Emerging unprecedented technologies are judged to be most widely used with greater R and E outlays, hence their impact is only included with annual real increments on R and E outlays of 7 percent, the highest rate used in this analysis.

As indicated above, the estimated annual average increases in productivity range from 1.10 for T_0 to 1.21 for T7+ fro-m 1975 to 1985. Historical annual increases in productivity averaged 2.33 percent from 1950-59, .92 percent 1960-69 and 1.19 percent from 1963-72. Historical productivity indices vary widely from year to year because of weather. Weather also influences the long-run productivity trend to the extent that weather cycles influence domestic farm production. No provision for weather cycles is made in productivity projections herein. This is not to deny existence of weather cycles, but rather to recognize that these cycles cannot be predicted with sufficient reliability to include in productivity projections.

Inflation.- Inflation in the national economy can be gauged by alternative measures including the ***Consumer*** Price Index, the Wholesale Price Index and the implicit price deflator of the Gross National Product. The latter is the most comprehensive in coverage of goods and services and historically has increased at a rate similar to that of prices paid by farmers, including interest, taxes and wage rates. From 1960 to 1969 both indexes increased by 24 percent. From 1972 to 1974, however, prices paid by farmers increased 32 percent while general prices increased 18 percent. Tire more rapid increase in prices paid by farmers is in part attributed to high energy prices, which carry,a larger weight in farm input prices that in general prices, and by the interfarm sales component of prices paid by farners, which increased in price commensurate with the rapid gain in prices received by farmers for crops and livestock. In the future the rate of gain in farm prices paid is expected to return to the historic pattern in relation to the rate of national inflation. In the empirical analysis, three alternative inflation rates are examined: I_0 a benchmark of zero annual inflation; I_4 the standard case of 4 percent annual inflation; and I_8 an 8 percent:annual inflation rate in prices paid to farmers.

The latter rate is considerably higher than the rate prior to the 1970's but lower than rates experienced in the 1970's by farmers. Inflation in prices paid by farmers influences prices received by farmers in the empirical analysis in conformity with the theory outlined elsewhere (Tweeten, 1975c).

Demand

The projected demand for farm output is expressed by price elasticities and by three demand shifters: exports, population and per capita real disposable personal income. Based on previous econometric studies, and ability to predict historically the 1967-74 period, the price elasticity of aggregate demand was selected to be -.15 in the short run and -.21 in the long run.

Population.— U.S. population growth rates are series I, II and III projections from the Bureau of the Census. With population increasing at the rate of .85 percent annnally from 1970-74 and by .7 percent in 1974 and in light of falling birth rates, series III with growth rates of .68 percent from 1975 to 1985 was selected as the standard case (Table 7). Alternative rates are also used because trends in birth rates cannot be accurately anticipated as evident by past projections. Accordingly, three projections are included in Table 1 to allow for possible changes in birth rates, migration and other factors that influence domestic population growth.

TABLE L-PROJECTED ANNUAL PERCENTAGE INCREASES IN FARM OUTPUT DEMAND, WITH ALTERNATIVE IN. CREASESIN DOMESTIC POPULATION, PERSONAL PER CAPITA REAL INCOME, AND AGRICULTURAL EXPORTS , UNITED STATES, 1975-85

Exports [2]	Population,* years 1975-85		
	I (1.20)	II (0.92)	III (0.68)
High income [3]	(3.0)	(3.2)	(3.3)
(2.7)	1.80	1.58	1.48
(3.5)	1.94	1.73	1.56
(4.4)	2.10	1.88	1.70
(6.0)	2.37	2.15	1.97
Medium income	(2.3)	(2.5)	(2.7)
(2.7)	1.72	1.51	1.33
(3.5)	1.87	1.66	1.47
(4.4)	2.02	1.81	1.63
(6.0)	2.29	2.08	1.90
Low income	(1.8)	(1.9)	(2.0)
(2.7)	1.66	1.43	1.25
(3.5)	1.81	1.58	1.40
(4.4)	1.96	1.73	1.55
(6.0)	2.23	2.00	1.82

[1] Roman numerals refer to Bureau of Census population series, with annual percentage rates in parentheses.
[2] Annual percentage growth in exports shown in parentheses below.
[3] Annual percentage growth in per capita income shown in parentheses below.

Source: See text. For further information see Economic Research Service, working materials No. CY. 1,75 entitled "United States Production Capacity Preliminary Projections to 1985."

Exports.—Agricultural export growth has been highly volatile in the past, and is hazardous to predict in the future. The three lower rates of future agricultural export growth were obtained from the Foreign Demand and Competition Division of the Economic Research Service (Table 1). Expressed as a percentage of the 1967 export volume, the actual quantity index of exports was 111 in 1970, 129 in 1972, 166 in 1973 and 155 in 1974. Under the alternative with 4.4 percent rate of growth from 1975 to 1965, the quantity of exports was projected to be 156 in 1975 and 206 in 1980. Under the 3.5 percent rate of growth alternative exports were projected to be 167 in 1980, only slightly above the 1974 level. The projections of 3.5 to 4.4 percent annual growth from 1975 to 1984 appear reasonable in light of present knowledge, but exports could increase at a faster rate. Exports increased on the average by 6 percent per year from 1967–74, with a large portion of the increase in 1973. While gains of the 1973 magnitude are rare, I inserted a faster growth rate of 6 percent for 1975–85 to account for possible repetition of the 1967–74 experience.[1]

Income.—The two highest estimates of projected increases in per capita disposable personal income were computed from unpublished data supplied by Resources for the Future. Rates of 3.3 and 2.7 percent for 1975–85 under population series III appear to be too high in light of the 2.4 per cent annual gain from 1967–74 and decline in real income from mid-1973 to mid-1975. Higher energy prices may restrain economic growth for an extended period. Consequently, I included lower growth rates in income as a third alternative, with real disposable personal income growing from 1.8 to 2.0 percent per year. Income growth estimates were unique to each population series because income and population interact—lower per capita gains in income are associated with high population growth. However, total national product is greater with higher rates of population growth because population increments are not entirely offset by per capita income losses.

The income elasticity of demand for food and fiber output at the farm level was considered to be .14 for 1975–85.

The 36 possible annual shifts in demand in Table 1 were too numerous to simulate separately and only three rates of growth in demand were considered.

[1] It is cautioned that these export projections do not measure the *need* for U.S. farm products abroad. Rather, the estimates reflect projected *effective demand* for U.S. farm products abroad, which depends, among other things, on ability to pay for U.S. farm products out of funds gained from international exports and aid credits.

It is noted that several combinations of export, income and population alternatives project the same shift in total demand for farm output. The very highest rates of growth in income and population seem unlikely to occur. Excluding the highest growth rates in income and population and thereby temporarily confining alternatives to 16 demand growth rates for 1875-85, the highest rate of growth *in* demand is 2.1 percent and the lowest rate is 1.2 percent. These rates coupled with a standard case estimate of 1.5 percent (which conforms with standard case export growth of 3.5 percent population growth of .68 percent and per capita real disposable personal income growth of 2.7 percent) constitute the three alternatives simulated and are designated as $D_{2.1}$, $D_{1.5}$ and $D_{1,2}$. It is apparent that these shift correspond to several combinations of components. For example, $D_{1.5}$ with a 1.5 percent annual growth in demand can result from population series II, medium income, and 2.7 export growth; or from population series III, low income, and 4.4 percent export growth. Demand growth $D_{2.1}$ can result from population series I, high income and 4.4 export growth; or *from* population series 11, high or medium income, and 6 percent export growth in the 1975-85 period.

SIMPASS System

The SIMPASS system as modified by Jung J. Yeh projected annually from 1975 to 1985 the farming industry economic outcomes including prices received by farmers, the' ratio of prices received to prices paid by farmers, gross receipts, expenses, net income and output. Parameters were initially selected for the system for the previous econometric studies, then finally selected based on the values of parameters which predicted most reliably the 1967-74 historic period.

Equilibrium

Economic outcomes under various scenarios were projected for each year from 1975 to 1986 in the absence of production controls or price and income supports by government. To save space' and because annual changes were along a fairly uniform trend, only values for 1980 and 1985 are shown (Table 2). Although prices received by *farmers* are projected to be 264 percent of the 1967 average in 1985 in the standard case (1.5 percent demand growth $D_{1.5}$. 3 percent growth in R and E outlays T_3, and 4 percent inflation T_4), the terms of trade for farmers as measured by the price ratio (prices received divided by prices paid) trends slightly downward because of inflation in prices paid. Current or nominal income measured in dollars of the future years shown in Table 2 *trends* upward, but real income trends slightly downward in the standard case.

Recognizing the possible errors in the projections, the most, realistic interpretation is that farm economic health will be very similar to that in 1967 on the average to 19$5 under the standard case scenario. But results 'could be quite different if other scenarios become reality.

TABLE 2.–PROJECTED, ECONOMIC OUTCOMES FOR EQUILIBRIUM UNDER A FREE MARKET, UNITED STATES, 1980 AND 1985

Scenario	1980 Price ratio 1967 equal 100	1980 Prices received 1967 equal 100	1980 Net farm income (billions) Current	1980 Net farm income (billions) Constant [2]	1985 Price [1] ratio 1967 equal 100	1985 Prices received 1967 equal 100	1985 Net farm income (billions) Current	1985 Net farm income (billions) Constant [2]
Standard case: $D_{1.5}T_3I_4$..	104	224	$24.2	$19.1	101	264	$26.9	$17.4
Productivity:								
High $D_{1.5}T_{[illegible]}I_4$	103	222	23.7	18.7	99	259	25.0	16.2
Low $D_{1.5}T_0I_4$	104	224	24.4	19.3	101	266	27.6	17.9
Inflation:								
High $D_{1.5}T_3I_{[illegible]}$	98	261	22.2	14.0	92	357	22.6	9.7
Low $D_{1.5}T_3I_0$	110	190	25.2	25.2	110	192	27.7	27.7
Demand:								
High $D_{2.1}T_3I_4$	108	235	29.9	23.6	108	287	38.6	25.1
Low $D_{1.2}T_3I_4$	101	218	21.5	17.0	97	253	21.9	14.2

[1] Ratio of index of prices received by farmers for crops and livestock divided by index of prices paid by farmers for production items, including interest, taxes and wage rates.
[2] 1974 dollars.

Source: See text.

Note: Preliminary actual 1974 values for the vice ratio was 106, for prices received was 183 and net farm income was $27,000,000,00 .

It is of interest that results change little with alternative rates of increase in outlays for research and extension. Farm income and price ratios are less favorable with greater investments, indicating once again that such outlays benefit consumers rather than farmers. Although R and E outlays have favorable rates of return and are a major economic benefit to consumers, they are not very effective in changing productivity rates for various reasons. As stated earlier, they comprise a small portion of all farm inputs and a change in volume is dwarfed by the effects of price changes on conventional inputs. Also, considerable time lapses before R and E inputs are reflected in farm output. A 25 percent increase in R and E inputs increases farm output only 1 percent over its lifetime. A 25 percent increase in the ratio of prices received to prices paid by farmers increases output 5 percent in 2 years and by 25 percent in the long run.

With no inflation (T_0), the ratio of prices received to prices, paid by farmers could be considerably higher by 1985 than in 1967, 1974 or 1980. Continued high inflation seriously threatens income of the farming economy, but does not seriously undermine ability of farmers to produce enough to meet food needs at home and abroad.

The high rate of growth in demand of 2.1 percent annually can result in a price ratio and real net farm income at nearly the same level in 1985 as in 1974. Such a rapid growth in demand seems unlikely, however. On the other hand a slow growth in demand of 1.2 percent annually could lead to chronically depressed farm prices and net farm income. And a combination (not shown in Table 2) of rapid growth in productivity, high inflation and slow growth in demand would create very serious economic problems for farmers which in turn would lead to powerful pressures for government intervention or perhaps to farmer bargaining power.

Results in Table 2 provide no evidence whatsoever that the ability of American agriculture to meet demands placed upon it will be seriously threatened. No evidence points to chronic shortages or suggests that an increasing proportion of income will have to be devoted to purchase of farm food ingredients by American consumers.

OPTIONS FOR COPING WITH ECONOMIC INSTABILITY

Projections to 1985 revealed no strong upward or downward trend in farm real prices and incomes for the foreseeable future. The overriding issue facing farmers and consumers is economic instability caused by variation in weather at home and abroad. Major means to reduce instability include commodity stock reserves, export and import controls, production controls and direct payments.

Commodity *Stock Reserves*

Establishing a commodity reserve program is the number one priority in establishing a national food policy. In the absence of reserves, farmers could receive stable prices and incomes by transfer payments from nonfarmers, consumers could receive stable prices by restricting exports, or foreign customers could receive stable supplies if domestic consumers reacted to widely “fluctuating prices by tailoring their food use to absorb all the adjustments in farm output. But more stable total supplies from year to year made possible by adequate reserves can avoid reliance on these distasteful alternatives.

Current farm’ legislation will not provide adequate public or private ***reserves.*** Emergence of consumer interests as a powerful and capricious force in national food policy has preempted reliance on the private trade to hold adequate stocks—the risks are too great. The private trade holds stocks when anticipated price gains more than offset storage costs, including a charge for risk. Fear that government action will truncate price rises injects uncertainty that leads to excessive private discount rates and to private stocks far below socially optimal levels.[2] Inability of the private trade to obtain capital and assume risks of holding stocks large enough to meet the requirements of a national food policy calls for public involvement.

We know much about an economically efficient stock program. Research suggests that carryovers of approximately 600 million bushels of wheat, 45 million tons of feed grains, and 150 million bushels of soybeans are optimal on the average. Stocks below these levels result in considerable price instability. Although reserves of the above amounts or greater create stability in commodity prices, the prices are considerably below current levels and are unpalatable to farmers (see Tweeten, 1974b).

2 An economically efficient program is one that maximizes the benefits less costs to society, with the private discount rate equal to the social discount rate at the margin:

In addition to optimal carryover levels, research suggests guidelines for release and acquisition of stocks. The optimal reserve management rule devised by Tweeten, et al. (1971) was to change stocks by the formula .85 (Q-Q*). That is, 85 percent of production Q in excess of equilibrium Q* would be stored, and stocks would be released (if available) equal to 85 percent of the shortfall of production below equilibrium. The percentage can be changed to as low as 70 without much loss in efficiency. A similar optimal formula was devised by Richard Just (1975), but with price rather than quantity the decision variable, i.e. the change in stock is given by the formula k (P*-P) where P* is equilibrium price and k is a constant which Just did not estimate. The change in storage stocks from year to year is some proportion of the difference between the actual market price and the equilibrium price. Expressing P in cents per bushel and Q in million bushels of wheat production in a linear demand function for wheat, and substituting Q into Just's formula, then the change in wheat stock is expressed simply as 2(P*-P). If equilibrium wheat price is 300 cents per bushel and the market price is 200 cents per bushel, then 200 million bushels would be taken off the market and placed in storage. If the price were 400, then 200 million bushels would be taken out of storage (if available) and placed on the market.

These rules may be economically optimal but politically inexpedient. Our research indicates that other guidelines such as acquisition and release of stocks when prices achieve respective low and high thresholds generate social benefits from price stabilization that are nearly as favorable as the optimal rule (Tweeten, et al., 1971). In part, this robustness of storage outcomes to storage rules is an outgrowth of increased private stock operations as government stock rules allow wider price fluctuations before intervention. The intervention prices must, ***of*** course, include the intermediate to long-run equilibrium price within the interval. Thus a fairly operational. rule is for the government to purchase stocks when prices fall 25 percent below equilibrium and sell stocks when prices rise 50 percent ***above*** equilibrium.

The socially optimal average carryover for the U.S. (nearly 60 million tons of all grains) appears not only to be consistent with the U.S. market but also with world contingency reserve needs. It requires fewer resources to maintain a single reserve system to accomplish the dual goals of stabilizing prices and responding to world emergency food needs than to have separate reserves for each goal. Rather than have a special grain reserve (a suggested level is 12 million tons, but more recent pronouncements go up to 60 million tons) solely for world emergency needs, it would be less expensive to accomplish the same objective by allowing countries experiencing acute food shortages to receive development dollar credits which could be used to purchase food wherever such food could be acquired at least cost. Commodity stocks are most efficiently stored in countries where they are produced rather than in potential food-short areas, but this idea is difficult to "sell" potential food-short countries. I am pessimistic about the ability of nations to agree on an adequate world food reserve policy, and feel that humanitarian considerations compel the U.S. to establish on its own a reserve policy capable of responding to emergency world food needs-at least until an international system is devised.

Farmers have observed correctly that small stocks have been associated with high, if unstable, commodity prices They oppose accumulation of reserves by the Commodity Credit Corporation because commodity prices would be low, although ***more*** stable.[3] To overcome farmers' opposition to reserves, a national food reserve policy must contain features attractive to farmers. One proposal is that stocks be held by farmers provided economic incentives by the government to acquire, hold and release stocks ***in*** the public interest. Notable legislation to implement this proposal is authored by Senator Henry Bellmen (Senate bill S 2275).

Senator Bellmen's proposed legislation gives producers an option whether to participate in the set-aside program or a stock program. If the producer elects the latter, he is authorized a nonrecourse loan equal to 80 percent of the cost of production, including land cost. The loan is for 5 years and is repaid with interest when the grain is sold. The grain can not be sold until the market price exceeds 150 percent of the loan, and the Secretary of Agriculture has the option of requiring loans to be paid off when the price of grain reaches

3 This statement applies to grain farmers but not necessarily to livestock producers. Stable grain prices are of benefit to livestock producers and reduce livestock price variability. Specialized livestock feeders can adjust to consistently low or consistently high feed prices, but it is difficult for them to remain economically viable with highly variable grain prices.

200 percent of the loan. Thus the farmer's selling option is essentially in the range of 150 to 200 percent of the loan rate. To illustrate with an example, if wheat production cost Is $3.06 per bushel, the loan rate is $2.45. The farmer has the option to hold the grain or to sell the grain and repay the loan with interest when the market price is between $3.67 and $4.90 per bushel. The loan is called when the price exceeds $4.90.

Other approaches can induce farmers to hold appropriate levels of storage stocks. One proposal is for the government to exempt farmers from payment of interest on the nonrecourse loan if farmers sell grain when the price is between 150 and 200 percent of the loan rate. Farmers would pay storage costs other than interest on the commodity. Another proposal is for the government to offer no nonrecourse loan but to pay farmers 25-35 cents per bushel to defray interest and storage costs up to 60 million tons of all grains. No storage payment would be made on stocks in excess of 60 million tons. Farmers would be free to acquire stocks as they see fit, but could release stocks only when the market price exceeded 150 percent of the support price. Because the grain industry requires working stocks which would not be readily accessible, the private trade would carry a significant amount of stocks. Payments for holding stocks would be terminated when market prices exceeded 150 percent of the support rate but would be reinstated when prices return to 150 percent of the support rate. If stocks failed to average. desired levels over a period of "normal" years, incentives would be raised or lowered as necessary. The storage incentive rates indicated above are only illustrative. The important principle is the use of government, payments to reduce private costs of storage to the level of retail social costs by compensating farmers (or others) for storage.

A third alternative is to establish a schedule of loan rates, with higher loan rates associated with lower reserves. The schedule would also include release rates, with higher release prices associated with smaller reserves. Farmers who stored grain would be exempt from interest charges (or would receive a storage incentive fee) if they sold grain in conformity with the release schedule, but would be required to reimburse the government for all interest charges if they elected to hold for higher prices. Direct payments or production controls would be used to maintain farm prices and incomes if stocks reached excessive levels.

Export controls

Opportunities for importers of American farm products to go elsewhere for supplies, the central importance of maintaining access to world markets to earn reserves to purchase petroleum and other products, fear of reciprocal trade barriers and other reasons have for the most part deterred demands for export controls.[4]

The Soviet Union has been in large part responsible for variation in U.S. exports and we feel much less obligated to assure supplies to them than to regular customers in Japan and Western Europe. But effectiveness of export controls or agreement with the Soviets should not be overestimated and viewed as a substitute for other measures to promote stability. In years of short Soviet supplies, their import needs in excess of what the U.S. is willing to supply can be purchased in Western Europe, (Canada, Australia, or Argentina. Customers normally purchasing from these countries but facing no U.S. embargoes or agreements can switch purchases to us. Or the Soviets can purchase soybeans, grain sorghum, barley and oats rather than embargoed wheat and corn. In years of abundant Soviet supplies, their commitment to buy 6 million tons of grains annually can be circumvented by their selling of domestically grown wheat to other countries. Possibilities for deferred delivery and other means also reduce the effectiveness of grain agreements to stabilize markets. Furthermore, because many farmers feel that commitments by the U.S.S.R. to purchase 6-8 million tons represent an export maximum in "the minds of U.S. officials, export controls or agreements cannot be viewed as a permanent instrument to stabilize markets by a nation committed to open trade channels and dependent on" access to world markets.

One way to remove the highly destabilizing impact of foreign markets on U.S. commodity prices is to restrict total exports, not just those to the U.S.S.R. and Poland. And the stabilization can be most effective if carried out in concert with other major exporters. Such policies, although potentially highly effective in

4 Attempts to obtain supplies elsewhere effects long-run as well as short-run markets. For example, stimulation of soybean production in Brazil by the Japanese undermines American soybean market outlets for many years.

removing export instability, can also raise export revenues from farm commodity sales.

In the past, some economists in the Economic Research Service have contended that the export demand far U.S. farm products is price inelastic. If this contention were correct, the U.S. could raise farm export earnings by unilaterally restricting exports. My estimates reveal an elastic demand for agricultural exports except in the very short run. Thus export revenue is lost by unilateral export controls but revenue is increased at least slightly if the U.S. restricts exports in concert with other exporters.[5]

Comprehensive, effective export control entails substantial costs. It would require either a single public grain board to replace current private export firms or powerful controls over private firms that would make such firms essentially an arm of the state. Whether the current grain export system comprised largely of private, mostly multinational, firms should be replaced by a single public corporation is an open question. While it is true that single state co orations predominate in major grain exporting countries, the advantages over reliance on private firms is not clear. A single public corporation would have served the U.S. better in the seriously mismanaged sale to the soviets in 1972. On the other hand, the Canadian Wheat Board missed the market in 1974-75. It held wheat anticipating exhaustion of U.S. supplies, only to face later a much depressed market price while holding substantial stocks. Under any circumstances, it is essential that the federal government monitor export sales, requiring prior approval for sizable sales. In my judgment, a national food policy with an adequate commodity reserve program can provide adequate stability without export controls. In other words, the cost of export controls (in foregone sales, ill-will, etc.) exceeds potential gains in the form of domestic price stability. But if export controls are to be used, the conditions under which they will go into effect should be carefully defined and advertised so that all participants in national food policy know the rules of the game in advance.

Production Controls

Production controls can enhance stability by reducing output and increasing prices and farm incomes in times of excess supplies and by increasing output and dampening prices and farm incomes in times of excess demand. Past programs have demonstrated that voluntary production control programs can in fact restrain output, provide a highly useful reserve of resources and serve secondary objectives such as conserving the soil and encouraging farmers to do what a more nearly perfect market would do (convert farmland to grass or trees, encourage alternative uses for farm labor, etc.) in times of excess Supplie.[6] If administered properly, production controls such as the set-aside program can maintain farm income, and can provide an intermediate-run reserve to back up short-run commodity stock reserves.

The shortcomings of production controls are many and accumulating. It is well to review them:

1. Ericksen and Ray (1975) state that ". . . land withdrawal may not be an acceptable remedy [for low farm income] since other parts of the world may still face shortages. The U.S. could face strong adverse world opinion if production were curtailed to support prices and farm income."
2. The balance of power in food policy has tilted toward consumers, and faced with the option of low-cost food or production controls, they can be expected to favor lower food costs.
3. Diverted acres were not very productive. At best, 2 out of 3 diverted acres return to production and those that return are no more than three-fourths as pro-

[5] The elasticity of demand for grains is approximately −1.5 except for the short run, indicating that a 1 percent restriction on exports raises export prices .67 percent but lowers export receipts $(1 + 1/-1.5) = .33$ percent. Since the foreign demand and supply elasticities are of somewhat comparable absolute magnitudes, the foreign demand elasticity can be multiplied by the ratio of foreign grain production plus consumption to exports to determine the export elasticity for one country or a cartel of several countries. This ratio is approximately 21 for the U.S. and is 13 for a cartel composed of the U.S., Canada, Australia and Argentina. The cartel price elasticity of export demand is approximately 13/21 times −1.5, or −.93. Thus a 1 percent restriction on grain exports by the cartel would raise prices 1.1 percent and would raise receipts by $1 + 1/-.93 = .1$ percent. The conclusion is that grain export earnings will be lowered by export restraint by the U.S. acting alone but will be raised by a cohesive export cartel which restricts grain exports in concert.

[6] Although in theory long-term whole farm retirement of marginal cropland is most cost-effective in removing production per Treasury dollar spent on the program, an Oklahoma study (Carr and Tweeten, 1974) revealed comparatively little difference among programs in Treasury costs to divert a given volume of farm output.

ductive as average cropland ; combining these two effects suggests diverted acres *were* only half as productive as average land in production. Although nearly one-fifth of cropland acres were diverted several years, this constituted a comparatively small reserve capacity of no more than 5 percent of farm output. Diverted land has little value for use other than farm production, and hence is virtually costless in real terms for producing farm output.

4, Reserve capacity is much greater from response to price than from bringing in diverted acres. The short-run price elasticity of aggregate supply of farm output appears to be approximately .2 for the 1967-74 period compared to .1 in earlier years. This suggests that the potential to respond to price doubled. A 25 percent increase in farm prices can generate as much production capacity in approximately 1 year as release of 60 million diverted acres. Alternatively, a 5 percent increase in prices received by farmers sustained for several years can generate 5 percent additional capacity.

5. In part because land now accounts for only about 15 percent of farm output and fertilizers and other purchased inputs are good substitutes for land, it is becoming increasingly difficult to control production by restricting the use of land.

6. Allotments are now obsolete, inequitable and an inadequate foundation for administering farm programs (see Schnittker, 1975).[7] Conserving bases have been eliminated in many states and allotments are inequitable within as well as among states. Farmers who responded to demands for greater output in 1973-75 by investing in land clearing, drainage, irrigation or other means to expand crop acreage do not wish to be penalized by a return to obsolete allotments used to distribute benefits of future government programs.

Direct payment programs have been criticized because they provide more funds to large than to small farms. This criticism may be much more applicable to set-aside programs, since, if production is to be controlled, large farms must be included to avoid diverting large portions of small farms. A direct payment program properly administered with payment limitations could maintain a family farm structure while providing disincentives to huge, industrial-type corporate farms. In combination with a commodity reserve program providing short-term price and supply stability, a direct payment program could give farmers "insurance" against economic and natural disaster at lower real cost than other types of programs.

Farm Price Supports

Price supports can serve objectives of equity and efficiency. By assuring farmers of at least a minimum return if things do not work out as anticipated, price supports can provide forward pricing that enables farmers to plan and produce more efficiently and provide any given output with fewer resources. Many economists agree that price supports can contribute to efficiency, but caution against the dangers of supporting prices above the long-term equilibrium (70-75 percent of 1910-14 equilibrium on the average according to Table 2). Higher prices escalate land prices, generate surplus output or entail high Treasury costs for production controls, support payments and storage of excessive reserves.

In July 1975, target prices were 45 percent of parity for wheat and corn while loan rates were 30 percent of parity for wheat and 36 percent of parity for corn. A considerable amount of production is not revered by target prices. Farm income would be cut in half compared to 1973 if prices fell to loan levels and would be inadequate to avoid a major financial disaster-eliminating many young, efficient farmers who have much to contribute.

Many feel that loan and/or target prices should be raised. The high value of building stocks should be reflected in high prices paid for reserves so that incremental output will not be channeled into production of mea? exports and other less valued uses. The current loan rate is too low to encourage production and bring commodities into storage. Alternative bases for setting loan or target prices include (1) the index of prices paid by farmers, (2) the index of prices paid by farmers adjusted for yields, (3) a moving average of past prices, (4) cost of production, or (5) a price necessary to bring production consistent with desired stocks.

Setting price supports according to the index of prices paid by farmers fails to account for productivity gains which enable farmers to obtain a fair return

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[7] Requirement that farmers rotate set-aside land from one field to the next each year until over a period of time every field on their farm has been diverted at one time or another can he successful in obtaining diversion of "average" cropland, but is of unequal success in humid compared to arid areas. In the latter, rotation of set-aside land may be little more than a fallow system that has no impact on total farm production.

even as price supports rise a little less rapidly than prices paid by farmers. Price supports tied only to prices paid by farmers eventually cause problems of excessive production.

Setting price supports at a moving average of prices over the last, say, 3 years allows prices to adjust to market conditions but without tying prices to an absolute period of "parity" which creates rigidity in prices. Because of high crop prices in the past three years, a past 3-year average support price could induce overproduction if excess demand quickly 'turns to excess supply in the later 1970's. Also a sustained period of excess supply can lead to very low price supports. Target prices are currently inflated by the index of prices paid by farmers and deflated by past 3-year yields. The latter adjustment unduly reduces support levels because yields include output gains from added conventional inputs as well as technology, hence overestimate productivity gains and overdeflate supports. Yield adjustments also are inappropriately sensitive to weather. Despite expected continuing inflation in prices paid, target prices are projected to fall in the late 1970's because of recovery of yields after unfavorable weather in the mid-1970's (Ericksen and Ray, 1970, p. 17). (It is possible that the Secretary of Agriculture will not reduce supports even if the prices mid and yield adjustments call for such action.)

Cost of production support prices are not receiving greater attention. Recently proposed legislation would support prices at 80 percent of the cost of production, including a land charge calculated from crop-share rent. An 'alternative to not validate escalating land prices caused 'by speculation is to support prices on the basis of non-land costs of production, with appropriate adjustment for spatial demands so that production would not move out of areas with a comparative advantage to high cost areas. Supporting prices at the non-land cost of production in the major area of comparative advantage with the cost of transportation added to supports for other was has considerable appeal.[8]

A final approach is to set the support price a year in advance based on expected supply and demand. Flexible loan rates could be geared to build desired carryover. Estimates would be made of expected utilization and beginning year supplies. Loan rates would then be set at that level which would bring expected production to a level that, when added to beginning year supplies less utilization, results in desired carryover. Market price is mainly a function of expect@ carryout, hence market price and utilization would remain quite stable. But price supports could vary widely from year to year, and the government might reimburse farmers the amount the support price exceeds market price. The Treasury cost of the program would be considerable, but the real cost, measured by output deviating from that of an ideal system would be small.

Whether stocks would be held by the government, farmers or the private grain trade is a separate issue. But if farmers and the private trade are expected to hold and release stocks in the public interest, incentives such as government payments of all or some fraction of storage costs could be built into the program. Price supports discussed above can be a ***nonrecourse*** loan rate (at that support price, fanners can place commodities under CCC loan; if market prices fail to rise they can turn in the commodity as full payment of loan) or as a basis for setting direct payments.

As stated earlier, the current first priority when production (supply) exceeds demand at long-term equilibrium prices is to accumulate stocks. But suppose stocks become excessive and farm prices appear headed for low levels. one approach would be to invoke production controls at such levels that expected diversions would hold reserves to desired levels. Another approach is to have no production controls but provide farmers a direct payment equal to the difference between the market price and a minimum support rate based on non-land costs of production or other criteria listed above. It might be well to compute per unit payments on the basis of normal yields on allotment acres, with ***allotments some*** fraction (say 80%) of updated 1973-75 acreages. This procedure would discourage overproduction because additional farm output would receive the low market price. Payment limitations to say $20,000 or less per recipient would help keep down program costs, make the program more palatable to taxpayers and would provide a diseconomy that would restrain growth of large, corporate farms and help preserve family farms.

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[8] Preliminary estimates of 1975 non-land costs *of* production (full costs, including one-third share rent for land, in parentheses) in areas of comarative advantage were as fol-10WR : corn $1.55 ($2.06) per bushel. wheat $2.30 ($3.86) per bushel, soybeans $2. 85 ($3.79) per bushel and cotton $.45 ($.60) per pound lint.

NATIONAL MONTETARY-FISCAL POLICY AND NATIONAL FOOD POLICY

National food policy cannot be separated from monetary and fiscal policy for the nation because the economic vitality of farmers is seriously threatened by inflation as apparent in Table 2. The chief failure of our economic system. is that it is "lumpy"—it concentrates economic activity temporally (business and inflation cycles), spatially (inequitable income geographically) and inter-personally (case poverty within neighborhood, village, etc.)

Inflation is caused in no small degree by overheating the economy with excessive expansion in money supply and deficit spending to reach an unattainable full-employment target. Inflation not only reduces real prices and incomes for farmers, it also reduces farm output for consumers. Inflation also demoralizes consumers-although the farm parity ratio was considerably lower in 1975 than in the decade preceding 1973, consumers are deeply concerned about "high" food prices and place some blame on farmers although the principal source of high prices is general inflation.

Although jobs are moving to low-income rural areas, substantial pockets of low income remain. One reason more jobs do not locate is because industry must pay more than the real wage to locate. That is, industry pays the minimum wage, union wage or socially acceptable wage which is considerably greater than the real cost of hiring workers measured by lost output when underemployed persons leave old "jobs" for more productive new employment. Millions of workers including many farm workers and part time farmers are in poverty because their contribution to the value of employers' output is less than the wage. In short, it does not pay to hire them.

A wage supplement would increase national output and employment by allowing workers with low productivity to receive a socially acceptable total wage while being paid the "low" wage at which they can become employed. One proposal is that workers be paid 50 percent of the difference between a target wage of, say, $4.00 per hour and what the worker could receive from the market. For example if a worker could obtain only $1.00 per hour from an employer, the supplement would be .50 ($4.00-$1.00) =$1.50 per hour for a total wage of $2.50. If 2000 hours are worked per year, total income is $5000. A worker who received $2.00 per hour from his employer would receive a supplement of $1.00 bringing total *wage* to $3.00 per hour. Thus workers who receive the higher wage rate from employers earn more, encouraging workers to be employed at the highest wage rate. Competition among employers for workers would also keep wages *from* falling to very low levels. The plan unlike several other welfare reform proposals would encourage substitution of labor for leisure, would encourage family solidarity by reducing incentive for the father to desert his family to make them eligible for public assistance and would help raise incomes of the working poor (over 50 percent of all poor families in rural areas) to the level of incomes of persons on welfare. Unlike other major welfare reform proposals which would reduce national income, the wage supplement would increase national income and expand jobs especially in labor intensive industries. In short, a wage supplement can help to alleviate inflation, regional poverty and reduce "case" poverty among farmers and hired workers.

Treasury cost would depend on several elements including unemployment rate but would probably range from $5-$10 billion per year. For any given outlay, a wage supplement would generate more jobs, more real output and would target more specifically on the disadvantaged than would a public service employment program.

Many existing programs to end underemployment in rural areas are cost-ineffective and poorly funded. Studies (Nelson and Tweeten, 1957) show how underemployment can be alleviated efficiently in depressed rural areas with major benefits to hired farm workers and part-time farmers by generating more jobs locally. Furthermore, the mix of public programs that accomplishes development targets most efficiently is consistent with local citizens' goals and values based on a survey of residents in the areas studied (Tweeten and Brinkman, 1976; Tweeten, 1975d).

ADDITIONAL NEEDS FOR GOVERNMENT POLICIES, PROGRAMS AND INFORMATION SYSTEMS

This paper has focused main on programs for economic stability. The programs also are consistent with efficiency, but many other changes could contribute to a more efficient and effective national food policy. Several are discussed briefly below.

Research Administration

Our system of publicly supported research has a long and very distinguished record, and great caution must be used in tampering with the system. It currently combines elements of mission-oriented research focused on specific goals, commodities, etc. (notably in the Agricultural Research Service of the U.S. Department of Agriculture) and research permitting a great deal of Individual initiative and responsiveness to local needs (notably in State Agricultural Experiment stations}.

Yet in view of the declining productivity of publicly supported research, some hard questions should be asked of the research establishment: Is undue duplication (some replication is desirable) of research occurring among State Experiment Stations? Are imaginative, productive scientists being rewarded and provided resources while unproductive research resources are culled? Are research funds slanted toward applied research at the expense of basic research on altering genetic structures, etc. ? Are research funds being used to support teaching of inefficient, small classes? Do Experiment Station advisory committees represent those being served including consumers, commercial farmers, small farmers and minorities? What are the procedures for allocating research funds, and can they be improved?

Marketing Efficiency

Substantial marketing research resources have been devoted to uncover alleged exploitation of farmers and consumers by the marketing sector. After several decades of searching with little success for the bogeyman, it is time to turn more attention elsewhere. Opportunities exist for increasing marketing efficiency by fostering more competition among transportation carriers (e.g. eliminating back-haul and route restrictions, allowing greater flexibility in transportation rates to meet competition and permitting easier entry of new firms) removal of differences in subsidy rates between truck, rail and barge transportation, and making foods which require fewer resources ("synthetic" foods, bull meat, etc.) more palatable and accessible to consumers.

Foreign Aid

Foreign aid programs have been closely tied to the availability of grain surpluses in the United States. More efficient and equitable means can be devised to stimulate progress in developing countries, After evaluating foreign aid programs, Tweeten (1970, ch. 15) proposed that foreign aid be provided in cash or credit form, requiring only that imports purchased with aid funds be confined to items such as fertilizer plants, irrigation equipment, technical assistance and food purchases that contribute most to development. If U.S. food supplies are excessive, unit discounts would be offered equal to the cost per unit of paying farmers not to produce, if that is the alternative. Aid would be committed for up to five years in advance so that efficient development plans could be made. Because controlling population growth is vital to meet long-run world food needs, the U.S. should withhold aid to developing nations until appropriate family planning is assured. Channeling aid through multilateral agencies such as the World Bank has great merit, but is unlikely to bring much pressure for population control.

Occupational Safety and Environmental Programs

Numerous regulations and controls are being imposed on the food industry without adequate assessment of costs in terms of foregone output, resource waste and inconvenience. Where issues of agricultural production and environmental protection collide, those who favor increased agriculture production frequently are overruled by environmental impact statements which show environmental damage from undertaking the project. Impact statements should show output and employment foregone under various environmental protection options so that full benefits and costs can be assessed before decisions are made. Risks of causing people to receive inadequate food supplies must be balanced against the risk of using pesticides, growth stimulants and loss of wildlife from drainage of wetlands, for example.

Information Systems

The information system required for a national food policy is composed of institutions, data and analytical systems. Each component is deficient in some respects, and failures in one component can cause deficiencies in other components.

Useful recommendations to improve the agricultural information system have been set forth by Harkness (1975) and Hjort (1975) for the 0ffice of Technology Assessment. Improvement is overdue in the statistical capabilities of the agricultural attache system. Though helpful, this in itself has limited scope to improve the supply-demand data from the Soviet Union and Peoples Replublic of China, which have been the principal sources of unstable world markets in agricultural products. The Soviet Union itself seems to lack adequate data on commodity production and utilization. In part this stems from failure of its statistical reporting system, which can be improved. But in part the inadequate data stems from changes in production late in the crop season including failure to harvest grain in the fields because of inclement weather.

My simulation analysis as well as analysis by Blakley (1974) suggests that lack of data rather than inappropriate parameters was the principal source of inability to predict farm commodity price changes in 1973 and 1974. We appear to be a long way from predicting in advance poor harvest weather in the U.S. or the Soviet Union, failure of the anchovy harvest, changes in exchange rates and political decisions in centrally planned countries so that we can alter our production in the current year to keep supplies and prices reasonably stable. Improved information systems supplement rather than substitute for alternative measures such as commodity stock reserves to bring stability to the food system.

Economic theory, statistical techniques and computer capacity are adequate to obtain much more information out of available data. Data are adequate to formulate a simulation model of world agriculture that will supply preliminary answers to such questions as when and where should buffer stocks be acquired for a world food reserve, how large should stocks be on the average, where should they be stored and under what conditions should they be released? Many other opportunities to improve or add to modeling capabilities exist.

In analyzing production capacity, I was impressed with the lack of data on supply functions for critical inputs such as land and fertilizers. Some such information can be obtained from surveys proposed by the Economic Research Service. We can also obtain more information about the structure of U.S. agriculture by moving resources now used in the agricultural census to the Statistical Reporting Service (SRS) as proposed by Hjort (1975) as well as others. The agricultural census currently is processed much too slowly and is all too reluctantly made available in detail to analysts for policy research. Because SRS data are more reliable than those of the agricultural census which is no 1onger a census but a mailed sample survey, much can be gained by moving census resources to SRS to obtain economies of size, timeliness, reliability and increased responsiveness to data needs.

Program evaluation is an Important element of national food policy and rural development. It is not possible to evaluate the impact of proposed programs without objective evaluation of past programs, For the ***most*** part, agencies rely on their own personnel or hire consultants to evaluate their own programs. A large number of such evaluations contain substantial bias in the expected direction, overestimating effectiveness or benefits and underestimating costs. Agencies are understandably self-serving, and treat those (inside or outside evaluators) who provide unfavorable evaluations as ancient Greeks treated bearers of bad news-they remove the bearer from any further opportunity to bring unfavorable reports. Until a quasi-independent agency (or agencies) is established to evaluate major federal food, fiber and rural development programs without fear of being destroyed, public policy formulation processes will be inadequately served. GAO performs a useful role, but its coverage is limited.

SUMMARY AND CONCLUSIONS

The first priority in a national food system is to establish a commodity stock reserve policy. The emergence of capricious consumer-oriented actions to hold down prices has eliminated the option of relying on the private trade to hold adequate reserves.

Analysis of long-term trends in supply and demand strongly suggest that we will have future periods of excess supply that bring unacceptably low prices to farmers as well as periods of excess demand. If the Soviet Union had experienced normal weather in 1975, market prices would now be low. If normal weather prevails in the world in 1976, the opportunity will arise to accumulate reserves to avoid very low farm prices and provide stocks to hedge against unfavorable weather in subsequent years.

The loan rate can be used as in the past as the threshold price at which to accumulate reserves. But the current loan rate is far below the value to society of accumulating reserves. The opportunity to acquire buffer stocks could be squandered in using added supplies for domestic livestock feed, exports and as cutbacks in production by farmers in response to low prices. Continuation of the current policy leaves world food markets highly unstable in response to uncontrollable weather.

One proposal is that the loan rate be raised to the level of nonland production costs. This proposal would set the stage for accumulating reserves. But it is very important that guidelines be established for stock release as well as accumulation so that all participants are clearly aware of the policy and are less likely to interfere with it out of narrow political partisanship. Suggestions for appropriate stock levels and release policies (such as a 150 percent of the loan level) are discussed in the text. Analytical capabilities exist to simulate stock policies and have been used with success to examine the implications of the proposal by Senator Humphrey (Ray, Richardson and Collins, 1975) as well as others (Tweeten, Kalbfleisch and Lu, 1971).

If stocks are to be in the hands of farmers as proposed by Senator Bellmen, then incentives need to be provided farmers to acquire and release stocks in the interests of all participants in a national food policy. The government might pay farmers 25 cents per bushel of corn and 35 cents per bushel of wheat per year of storage, with the provision that payment cease when prices reach 150 percent of the support rate.[9] Carrying costs would again be available when the market price falls below 150 percent of the support rate, thereby retaining some reserves for subsequent years. Or the government might not charge interest on nonrecourse loans to farmers who follow preset stock release guidelines.

The nest issue is what to do when stocks accumulate to appropriate levels. A suggestion in the text is that farm prices be allowed to adjust to the market clearing level and direct payments (with limitations of $20,000 per recipient) be made equal to the shortfall of the market price below the support rate. The payment base would be acreage allotments revised to some proportion (say 80 percent) of 1973-75 acreage times normal yields. This latter procedure would mean that marginal output would receive the market price, which would strongly encourage necessary adjustments in output.

Emphasis is on buffer stocks because it is the only positive sum game for economic stability in an unstable world. With export controls to lower prices, farmers and foreign consumers lose. Price controls to reduce inflation discourage output required to meet excess demand and are self-defeating. With production controls to raise farm prices, consumers lose the output from farm land and labor resources committed to agriculture and of 1ittle benefit to society unless used in producing food. Although reserve policies emphasize crops, such policies also benefit meat producers and consumers. Recent experience has demonstrated that unstable crop prices seriously damage the livestock economy and cause sharp gyrations in livestock prices.

Some economists point to the insolation of producers and consumers in ‘Japan, Western Europe and elsewhere from 1972–75 price gyrations because they have very high fixed commodity price supports. They go on to point out that Americans unfairly bore the brunt of the price roller coaster. This is a vast oversimplification. Given the choice between high food prices some of the time (U. S.) and high food prices all the time (e.g. Western Europe, Japan), clearly U.S. consumers would opt for the former.

A number of other ancillary proposals to a national food policy are included:

1. A wage supplement would reduce normal unemployment, easing pressures on government to overheat the economy in search of greater employment with excessive monetary expansion and deficit spending. The reduced inflation therefrom would be of great value to the economic health of commercial farmers as well as others. A wage supplement would provide a socially acceptable income while expanding employment for low income, part-time farmers and hired workers. The target wage could be $4.00 per hour, the tax rate 50 percent. Hence workers earning $1.00 per hour would receive a subsidy of $1.50 for a total return of $2.50 per hour. If employed 2000 hours per year, total income would be $5000.

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[9] Supporting prices at non-land production costs would not likely entail large Treasury cost because the probability that market prices from 1976 to 1979 would fall below the soybean support rate (see footnote 8) is less than 1 in 100, below the corn support rate is 1 in 5, below the wheat support rate is 1 in 4 and below the cotton support rate is 1 in 3. In fart. non-land production cost support rates, while providing a useful price cushion and enough leeway to obtain efficient allocations from the price system, might not generate sufficient commodity reserves. Therefore, I suggested the farmers be paid 25-35 cents per bushel for storing grains to obtain adequate buffer stocks without excess costs and rigidities from high price supports.

2. A quasi-independent agency would be established to evaluate federal programs. Each major federal program for rural development environmental protection, occupation safety and other purposes would be systematically evaluated for full costs, benefits and cost-effectiveness in using public funds to reach program objectives.

3. In recognition that food aid is only a short-run palliative and that increased indigenous agricultural output and population control are the only satisfactory long-run solutions to the world food problem, the U.S. needs to provide continuing economic aid to countries which have or will develop programs to reduce birth rates.

Foreign aid to less developed countries could be committed in cash or credit form, with limitations that spending of such credits be confined to development purposes. If the major need is food output, the credits could be used to purchase fertilizers, fertilizer plants, irrigation equipment, technical assistance, and other resources to expand farming output. The commitment would be a fixed dollar value for an extended period--say 5 years. If agricultural or other U.S. commodities are in surplus, a discount would be allowed on such purchases.

4. Information systems can be improved along lines suggested by Hjort (1975) and Harkness (1975). More and increasingly reliable data are needed on world food demand and supply outlook, economic health of the farming industry, and potential supply at alternative prices for inputs (fertilizers, land, irrigation, etc.). Analytical capabilities need to be improved for examining the implications of alternative world food reserve systems.

5. The appropriate federal structure to administer a national food policy is not clear. In a recent paper (Tweeten, 1975a) I cited shortcomings in the current policy formulation system including failure of consumers to enter the dialogue while farm policy is being formulated. Consequently, farm legislation is vetoed as consumer interests emerge at the last minute. Consumers of course are very legitimate participant in policy information but their spokesmen are frequently ill-informed. While I have no specific recommendations for institutional changes in the federal structure, I do feel strongly that consumers should be more closely integrated into national food policy formulation. This integration might well extend into research, extension and information systems as well as into policy formulation. In part this will be an educational process for producers as well as consumers

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[The following questions were submitted by Senator Humphrey to Dr. Tweeten and his answers thereto:]

Question 1. If an international reserve program is not agreed to within the next year or two, what would be the maximum desirable level of U.S. reserves?

Answer 1. As indicated in my paper, reserves on the average should be approximately 600 million bushels of wheat, 45 million tons of feed grain and 150 million bushels of soybeans at the end of each crop year. It is unwise to place a maximum limit on U.S. reserves, but measures should be taken once reserves reach optimal levels to restrict supplies. This can be done either by production controls that would remove sufficient production to maintain reserves at desired levels, or by direct payments to maintain farm income while relying on the price mechanism to restrain production and hold down stocks. In any given year, because of unpredictable weather and factors, stocks could go above or below desired levels.

Question 2. Should the maximum desirable level be established by Congress, by a presidential commission, or by some other means?

Answer 2. I feel that the desirable level of reserves and the mechanism for obtaining those levels should be established by Congress

Question 3.. Am I correct in believing You favor discontinuing price support loans when maximum desirable stocks have been accumulated ?

Answer 3. In one of the proposals I presented in my paper (the one discussed in my presentation to the Board) I suggested discontinuing commodity loans when desired stock levels are accumulated. The support price would continue, however. A direct payment would be made to farmers equal to the difference between the support price and the market price on allotments which would be 30 percent of the

1973-75 base acreage. Thus, the government would not continue to accumulate stocks.

Question 4. Could government costs be lowered by accumulating even larger stocks, if required, to support market prices?

Answer 4. Once government commodities stocks have accumulated to the levels indicated above, the real cost of holding additional stocks becomes large. This is because excessive stocks have little value and are likely to be held several years. In approximately 4 years the cost of holding stocks is greater than the original price of the commodities. The chances of releasing the stocks for profit are exceedingly small. Thus it is cheaper to pay farmers not to produce (or to use direct payments and depend on the price mechanism to restrain production) if stocks become excessive.

Question 5. Have you estimated the relative cost of stabilizing farm income by deficiency payments rather than by cropland set asides?

Question 6. If so, how would they compare?

Answer 5 and 6. It is more costly to the Treasury to stabilize farm income by deficiency payments than ***by*** cropland set aside. But this is only one aspect of the issue. Social costs can be defined as the reduction in total volume of goods and services produced in the nation with one program versus another. A direct payment program by this measure is less costly than an acreage diversion program which removes resources from production ! Furthermore, direct payments are more flexible and can be made more equitable among farm income groups.

Because acreage diversion programs have been run very inefficiently in the past, the Treasury cost of direct payments would perhaps be only 50 percent larger than the cost of a cropland set wide program to achieve the same net farm income. Costs to consumers would be lower with direct payments, however.

Question 7. What is the estimated cost per bushel, not including land charges, of producing wheat? Corn? Soybeans?

Answer 7. Preliminary estimates of 1975 non-land costs of productionin areas of comparative advantage are as follows: corn $1.55 per bushel, wheat $2.30 per bushel, soybeans $2.85 per bushel and cotton 45 cents per pound lint. These non-land production costs apply to Iowa-Illinois for corn, western Kansas and northern Oklahoma for wheat, Illinois for soybeans and the Texas high plains and Mississippi Delta for cotton. Support rates tied to non-land production costs would be adjusted for transportation and other factors so that rates would be higher in other areas of the country than those indicated above. These support rates are not high, and would not entail large government costs for deficiency payments. They can be faulted for not being high enough to generate sufficient commodity stock reserves. Accordingly I suggest that, to obtain needed stocks, farmers be provided a payment of 25 to 35 cents per bushel to encourage them to build stocks to desired levels. As a condition for receiving this payment, farmers would agree not to release stocks at less than 150 percent of the support rate. Thus working stocks would have to be provided b the private trade.

Question 8. You do not expect much benefit to United States from the recent Russian grain agreement and you do not propose changes in existing statutory export control authority. In view of the disturbing effects of recent voluntary restraints imposed by U.S. without consultations, how should an unusually large export demand by the Soviets, such as occurred this fall, be handled?

Answer 8. As indicated in my paper, I feel that it would be unwise to expect too much from the recent Russian grain agreement. It is not a substitute for commodity stocks and other measures to stabilize markets. I feel that exports should be monitored, with reporting required only for impending sales of significant size. The purpose is to keep the Soviets or any other nation from exploiting our fragmented export structure by buying from several firms at one time, with no one of these firms realizing the magnitude of the overall sales and hence, misjudging price. If commodity stocks were adequate in the U. S., a large export demand such as occurred in 1975 could be handled without export controls.

Question 9. Have You estimated the cost of a wage supplement Program? How many workers might be affected?

Answer 9. The costs of the wage supplement program would depend on a number of factors including the degree of unemployment in the economy, the target wage, and the proportion of the difference between the target wage and the market wage made up by subsidy. Costs would range from $5 billion to $10 billion per year. Several million workers would be covered and the exact 'numbers have not been worked out. However, I strongly emphasize that the cost which I indicated is that to the Federal Government. Again, measured by the real economic costs defined as the reduction of goods and services produced below that of a perfect market, the wage supplement would be very low cost because it would increase output of goods and services in the country.

Question 10. How would your suggested quasi-independent agency for evaluating Federal programs differ from the General Accounting Office?

Answer 10. A problem with the General Accounting Office is the limited coverage provided. In a very extensive review of rural development programs, for example, I found virtually no programs evaluated by GAO. Furthermore, GAO provides comparatively few benefit-cost analysis—their evaluations are more of a general nature. The quasi-independent agency I proposed would have much broader coverage and economic analysis in depth.

Question 11. Why not reorganize the GAO and have it make cost-effective evaluations of Federal programs?

Answer 11. I have ***no*** quarrel with reorganizing the GAO and providing more funds to more completely evaluate federal programs. Some might raise the issue that, just as executive evaluation agencies tend to bias results in favor of programs supported by the President, GAO might be faulted for bias ***in*** favor of programs supported by the Congress.

Question 12. How can United States stimulate increased family planning programs in the developing countries without incurring their ill will?

Answer 12. The United States would incur some ill-will in promoting family planning programs in developing countries. The amount of ill-will generated I believe would be a small price to pay for the long-run contribution to the well-being of the people that would ensue.

Question 13. What is an "optimal reserve management?"

Answer 13. Optimal reserve management is one which minimizes the social cost, where social cost again is defined as the deviation of output of goods and services from that of a perfect market. It has great value as a measure of the worth of a policy because it does not consider the interest of consumers apart from farmers or taxpayers. It is the best single measure that economists have of the contribution of a policy to ***overall*** national well-being.

Question 14. How is the "equilibrium price" computed?

Answer 14. The "equilibrium price" in a stock change formula can be computed from existing analytical tools. In practice, however, we can come close to estimating an equilibrium price simply as the full cost of production, including 1/3 land rent, for any particular commodity. Such estimates can be supplemented with other more sophisticated devices such as predictions from econometric models. The equilibrium price need *not* be estimated exactly; it is only necessary that the equilibrium price fall within the bounds of stock accumulation and release prices. If loan prices chronically exceed equilibrium prices, problems emerge of excess production, burdensome commodity stocks and/or high Treasury costs.

Question 15. Do you think there should be mandatory public reporting of all export transactions?

Answer 15. I do not advocate mandatory public reporting of all export transactions. Only exports for major commodities and of significant magnitudes need to be reported. This should in no way be conceived of or operated as an export control device. Rather it is a means of keeping informed in case very large export transactions are involved. The fundamental problem with our export system is that large purchases such as the grain sales to the Soviets in 1972 can move us far up the demand curve to a substantially higher price. But without information on the degree of sales, the sales price is at a much lower level. Failure to communicate the magnitude of sales allows a monopolistic importer of American farm products to exploit our fragmented export ***system.***

Chairman HUMPHREY. Congressman, do you want to ask some questions first?

Mr. 13 BROWN. Senator, I have some questions but I certainly would like to yield to you.

Chairman HUMPHREY. I want to yield to you.

Mr. BROWN. I am a little reluctant to take the time to ask questions in view of the far greater familiarity' with this area that Senator Humphrey has and the great contribution he is making in all its various areas, including the Technology Assessment Board.

However, I have become convinced that there is going to be a need to stabilize basic commodity prices, particularly grains, which enter into the export market in far greater degree than any other commodity; and that only where we do have a degree of stability can we undertake a reserve program which is equally important.

I note in the testimony of all of you gentlemen comments with regard to this or comments that relate to it.

For example, Mr. Jaenke has pointed out what he described as the 18th century laissez-faire philosophy which motivates the present administration of the Secretary of Agriculture, and of course that philosophy is not favorable to a program of price stability.

On the other hand, the other two papers contain specific recommendations for stabilization of grain prices. Dr. Cochrane's paper suggesting that a price level could be held within a plus or minus 10 percent figure; and I gather Dr. Tweeten feels a greater range of price stability, price levels, would be necessary.

The point being, however, that we need to have both a bottom and a top. We need to recognize that the one ***protects*** the farmer; the other protects the consumer. And hence they are both essential.

May I ask, and this is preliminary to the question, those of you who have commented on this problem of stability of price, do you think that agreement could be reached on a spread, whether it is plus o-r minus 10 percent or some other figure that would do the job, both of protecting the consumer and protecting the farmer and his income, given an administration which was not devoted to l8th century laissez-faire economic philosophy ? Is that a possibility ?

Dr. COCHRANE. Let me make two or three comments. Here I will be quite political because I think the answer is political.

No, I do not think that this administration will push the kinds of ideas that are necessary to bring it into being, both internationally or at home. I think, in a 1 fairness, we should recognize that our grain farmers typically do not like the idea of a legitimate reserve stock program with both price ceilings and floors. They are quite opposed to any kind of program that would put any kind of ceiling on prices.

Mr. BROWN. They are not reluctant----

Dr. COCHRANE. They want a floor. The want a "Heads I win, tails you lose" proposition, which they have become used to over a long period of time.

To bring the program into being would take—would take two or three things, It will take leadership internationally, and it will take leadership here at home.

I agree with Dr. Tweeten, I am not quite sure of the mechanics, but some kind of sweetener is going to have to be offered to farmers to get them to come along, because I think what farmers really believe, and I believe it, too, in light of what I said, that there are going to be more high price years than there are going to be down years in the next 10 years.

If you believe that, then you will be reluctant to put a price ceiling over yourself. Whereas, consumers, I think, realize that things are not so happy for them, and hence the pressures typically come from the consumption side.

So I think a great deal of leadership, both internationally and domestic, is going to be required to bring into being an effective grain reserve stock program. I think some sweeteners are going to have to be offered to farmers to keep them from bucking in very hard. I am talking specifically of the grain farmers.

Livestock farmers might be a bit more happy to go along with it. But this is not a downhill pull, or it would 'be occurring now.

It is going to take some real leadership to bring such a thing about, and there is going to have to be something in it for farmers to keep them from dragging their feet badly. I do not talk to any grain farmers who even want to talk about a grain reserve program.

Mr. BROWN. Mr. Soth wanted to make a comment.

Mr. SOTH. That is absolutely correct as far as grain producers are concerned and soybean producers. I hear the same thing that Dr. Cochrane mentioned.

However, I think that livestock producers, the poultry industry, and the cattle people particularly, have a somewhat different attitude. That attitude of livestock men is not being reflected in the policies of the leading farm organizations. But they understand, I think, better than the grain farmer this instability problem.

There are lots of cattlefeelders that were wiped out a couple of years ago, and the poultry industry has been hurt by these gyrations in prices. I think they would support and welcome an effort of this kind.

I would like to emphasize one more time that an effort at national planning, where the Government and leading farm organizations and others sat down together and tried to set forth some goals on production, what we need for reserves and so on, would be a fine educational process, that we would all have a better basis for looking to the future and for establishing these reserves than going the way we have been going.

Mr. BROWN. Thank you.

Mr. JAENKE. I disagree with at least one of the statements, particularly that Dr. Cochrane just made, that farmers do not care about this whole question, and they only want something at the bottom and do not want anything at the top.

I work closely with a number of farm groups and from that experience I do not agree that farmers are insensitive to adverse effects on other groups.

Mr. BROWN. I believe they were trying to separate elements within the farm community.

Mr. JAENKE. Let's put this in proper context. Farmers do not have a floor under their prices. When you talk about $1.37 for a bushel of wheat as a loan price, well, that does not even cover starting out and getting the land ready. Farmers have had no experience with any reserve program, only with surpluses. There has been no leadership talking about this. There has been no effort to develop the rationale and logic to show that there are benefits to agriculture, not only livestock people, but there are benefits to grain people, too, of a well-planned reserve.

They have nob had this full impression of what can happen and what the benefits of this can be. So what they have is a meaningless, totally meaningless, support program or floor program. With these conditions they worry about what level the top cutoff is going to be. And in those sort of circumstances, I am with those grain farmers in not wanting a reserve. But that is not what we are talking about, I hope, in this hearing. The consensus of the discussion at the hearing has been that we are talking about something that combines a meaningful floor with some type of meaningful reserve to protect against skyrocketing polices.

Right now, we have got grain price ceilings, but they are made b a luncheon meeting of third level State Department officials with some foreign government.

Mr. BROWN. Do you think it is possible to achieve some reasonable agreement as to the levels of floor and ceiling prices that would be realistic ?

I was a little bothered at this content of plus or minus 10 percent.

Dr. COCHRANE. Let me speak to that.

What I was talking about was a price stabilization range of plus or minus 10 percent, say, for 1976 of the most recent 3- ear average, and that is a pretty high range. I am not suggesting to farmers that they go back to a pre-1972 price level for the grains. I have argued, wherever I speak, that the level of price support should be raised—in fact, what I was suggesting is the following:

That we try to stabilize prices around a moving 3-year average of prices and it would begin with the last 3 years. The international program would acquire stocks at the bottom of the range-that is at 10 percent below the 3-year average-to put a floor under the range, and sell stocks at the top of the range—that is, at 10 percent above the 3-year average-to put a ceiling on the top of the stabilization range.

I have also argued elsewhere that the loan rates for all farmers in the United States, in such a program, could appropriately be raised to the bottom of this stabilization range. Maybe if farmers understood it-maybe if they understood it--they would be more favorable to the stabilization idea. I am not talking about peanuts f-or them.

Mr. JAENKE. The answer, in my judgment, is yes. I think that this can be worked out.

Mr. BROWN. There are going to be two kinds of objections to stabilized prices. By stabilized, I mean those that provide a set price range.

First, the objection that that is not the business of a free market system or a Government that is committed to free market policy.

Second, that whatever prices you set, there will be arguments from - others who may agree in theory that there ought to be price stability, but that the prices chosen are wrong, that you have not properly protected the farmer or the consumer.

The consumers will object if the ceiling is too high. The farmer will object if the floor is too low.

So I am disregarding the first objection, based on the 18th century as a fair economics, but I am trying to pinpoint the degree to which we might be able to reach agreement on the spread between the base and the ceiling.

Dr. TWEETEN. I wanted to say a little bit on the issue of floor prices.

One of the problems, when you try to retain the very narrow range of prices, is that it entails in many cases very substantial resources to keep prices within that range.

Mr. BROWN. If I may interject. it has been my experience analyzing productivity figures in many areas that there is a normal difference in productivity, that is the ability to produce at certain unit costs, and it is at least 20 percent, and maybe more in many areas.

Dr. TWEETEN. Even more than that.

Take, for example, soybeans. The nonland production cost in Illinois is about $2.85 a bushel. The land cost is nearly 50 percent of nonland cost of production.

If you allow price to rise 50 percent above loan rate, set at the nonland cost of production, and allow it to rise no further, you cut off chances for a profit. Furthermore, if you raise the loan rate substantialy above what I suggested, then you face a problem of restraining production, because price supports will encourage overproduction.

I was trying to pick a reasonable compromise on support prices in light of the fact that I think there are many who feel supports should be sharply higher while others feel there ought to be considerable market orientation in farm programs.

Mr. BROWN. I think initially any stabilization program is going to have to be fairly broad in order to give some sort of allegiance to the effect of the market or some sort of recognition to the effect of the market. It may be possible to narrow it later as we get further experience with it.

Dr. COCHRANE. Well. I agree and disagree with most things that have been said recently, but let me comment.

If you had an average price of wheat, of say $4, a range of plus or minus 10 percent is $3.60 to $4.40, this is an 80-cent range. That is enough to give people signals about what resource adjustments are needed.

If the stabilization range gets much bigger, or, if the range is as big as prices fluctuating anyway, then you are only giving lip service to stabilization.

I might agree to say plus or minus 15 percent; or you might say minus 5 plus 10. There are all sorts of price range combinations.

But the point I want to make is that a range of $3.60 to $4.40, is 80 cents, is not a small range.

Mr. BROWN. How does that compare with the actual range ?

Dr. COCHRANE. When Mr. Jaenke and I used to be in the Department, that would have been a hell of a big range.

Mr. JAENKE. Based on recent years, it would look much more too narrow. I would prefer to see a wider fluctuation within this thing.

The range for wheat has been from $2.90, $3 to nearly $6 a bushel over the last 24 months.

Dr. COCHRANE. Is that good?

Dr. TWEETEN. Nonland cost of wheat production in western Kansas and northern Oklahoma is about $2.30 a bushel. And, furthermore, the total cost with one-third share is $3.06 a bushel. Excess supplies of wheat will build without production control with the price supports that Dr. Cochrane is talking about.

Mr. SOTH. What we are talking about, all of us. I think. is stability around a long-term trend. We are not trying to tinker with the long-term trends in cost and demand and supply.

Mr. BROWN. All of you seem to agree that the long-term trend is upward.

Mr. SOTH. That is where we are going to argue-

Dr. TWEETEN. Great fluctuations.

Dr. COCHRANE. I am going to ask a question of my colleague here.

Mr. BROWN. I encourage you to do so if it will contribute to the record.

Dr. COCHRANE. I know how much market prices have fluctuated in the last 2 years.

Were you saying we want a "stability" where prices fluctuate that much in the future, or do you want to narrow that range down?

I am not sure what you were saying.

Mr. JAENKE. I want to narrow the range but not as much as you do.

Dr. COCHRANE. OK.

First, I would like to say, Congressman, that I do not argue that plus or minus 10 percent is the correct stabilization range. It might be plus or minus 20 percent, or there can be other kinds of stocking rules.

I would like to argue with my colleague, Dr. Tweeten, though, that I do not think land costs are relevant to this discussion. Land costs in this context are totally meaningless.

Land costs go anywhere that the price level goes.

What is really important, and I think it is implied in my statement, is that the nonland costs are important.

Land costs simply rise and fall with price levels. That does not mean it is easy for farmers. In fact, if we should get a big decline in prices now, and prices should fall to where they were, one of the anguishes that farmers would go through would be deflating their assets to a new price level.

But what happens to land costs does not impress me at all—what happens to land costs is simply what happens to price levels 2 or 3 years later.

Mr. BROWN. I would think it would be material only if there is quite a bit of entry into or exiting from—

Dr. COCHRANE People very quickly capitalize increased returns. You do not have to be 'buying the land to capitalize the value of the land sales values into your asset value.

Mr. BROWN. Dr. Tweeten.

Dr. TWEETEN. The only thing worse than viewing what happened in the 1960's as the guide to the future is to view 1973 and 1974 as the guide to the future. Our analysis indicates that what happened in 1973 will happen only once in roughly 35 years. I submit that if we had a more intelligent commodity stock program and an acreage diversion program more responsive to emerging events, we could have avoided many of the undesirable consequences of the 1972-74 period.

I do not think we would want to pay the price for a security policy that would avoid any price rise in response to a very rare circumstance such as occurred in 1972-74.

Mr. SOTH. They developed again in 1975.

Mr. BROWN. Let me offer a simple hypothesis, and then please comment after that.

Recognizing the nature of the political process, which makes change by incremental stages only, would it be reasonable, if we were to propose the introduction of a stabilized agricultural price program, coupled with a reserve program, to look at the fluctuations over a recent period of history—take whatever you wish, 3 years, 5 years-and develop price levels, upper and lower, which were less than those swings but which perhaps were not drastically less and that we then seek to obtain from experience after 1 year or 2 or 3 years of this to optimize that spread in order to achieve the policy goals of full production and adequate reserves that we are seeking to obtain?

This I am suggesting from a political standpoint as probably being the way that it would occur anyway. Is there anything wrong with that ? I would like to hear your comment, Dr. Cochrane.

Dr. COCHRANE. Would you restate the position. I am not sure I understand exactly.

Mr. BROWN. I am suggesting that we look at the price swings in the commodities such as wheat or soybeans. They vary in the amount of the swings, of course. And that we seek at an initial stage in stabilizing prices to confine the upper and lower levels within a range smaller than those actual fluctuations over some reasonable period of time on the basis of experience, determine the optimum range that we want to have as our price stability program.

Dr. COCHRANE. Yes, that might be the way to go about it. I agree, you begin not by narrowing down the range 'of fluctuation too much. You begin gingerly, and as you gain experience with the program, you could tighten it down. I think that is one way to begin.

I was not trying to sell this 10-percent range. I was only using it to illustrate. But I think there is an important point to what I was saying: It is that you could do an effective job of holding world prices in such a range with an average reserve stock of about 60 to 70 million tons, which is considerably less than the U.S. Government held in 1960. I am using the 10-percent range to illustrate the magnitude o-f the job.

The way to begin might well be to begin with a much wider stabilization goal or objective and then when you have gained experience to possibly tighten it down. And maybe you would never want to tighten it down. I do not know.

Mr. BROWN. Let me interject one additional point from my own information and for the record. Can any of you contribute any information as to what the range of prices has been maintained at in other countries separating market and nonmarket countries, if you have that information ? This would provide some sort of basis for analysis and precedent if we had that kind of information.

Mr. JAENKE. We could certainly provide it, yes. In a nutshell though, for those importing countries in the commercial market sector the prices ranged right along with what our prices ranged because they were coming into world markets.

Mr. BROWN. Many of those maintained domestic controls.

Mr. ,JAENKE. Almost every country has a much more government-structured program for maintaining grain prices, and generally around the world those grain prices—I am speaking just of grain—are somewhere between 25 and 75 percent higher than U.S. prices have been over the last decade.

Mr. BROWN. obviously any program has to start with probably wheat, and corn and maybe then more control to others——_—

Mr. JAENKE. And rice.

Mr. BROWN_. Yes. I am again looking at it politically. We start with the highest priority and move down the line.

Dr. Tweeten.

Dr. TWEETEN. Some have pointed with approval to the Japanese and Western European system. They have high fixed support rates. They largely avoided the gyrations of prices that occurred in 1973 and 1974 in this country. Some people look at this with approbation because they did not experience instability,

I submit that if American consumers are confronted with the possibility of high prices once in a while, versus high prices all the time, as you find in Western Europe and Japan, the will take the former. On the other hand, we can develop policies that more effectively reduce instability.

Considerable analytic capability using simulation models exists to operate on a small scale the farm economy over a period of years to learn how various policies would work.

One of the complaints among farmers and others is that policies keep changing. Farmers like to know the rules of the game, I think they would even put up with export controls if they knew the rules of the game. In other words, farmers want a policy established in advance. They do not want a trial and error system.

Mr. BROWN. I would concur wholeheartedly with that. and yet the problem basically is that we have in this great democracy of ours national administrations with widely divergent philosophies, and this reflects the fact that the people of this country, not being economically sophisticated in general, have widely divergent ideas as to what is the best kind of program. They tend to see the situation from their own rather narrow point of view and not with regard to long-term economic reality.

Mr. Jaenke, we have not dwelt too much with your own proposals having to do with organizational change, and they pose some rather interesting possibilities. I would like to invite any of the other panelists if they would care to comment with regard to the suggestions made by Mr. Jaenke with regard to the restructuring of the organizational aspects of this matter, and you here have an opportunity to get back at him for what he may have said.

Dr. COCHRANE. I found his comments very interesting. My reactions run as follows: I find his first proposal and his third proposal the most easy to live with. I cannot visualize this policy organization, the second proposal that had no implementing power, very easy to live with. I do not quite see how it would work.

M-y reaction would be first to to his first proposal, namely. that there bean assistant to the President that has the responsibility of trying to coordinate these various agencies and have a food council that reported to him. That in my judgment is the place to begin, and it ought to begin soon.

The Congress then might well want to review his third proposal and give it some serious thought.

Some of these things can be pulled together very easily but some cannot. Take transportation—the transport system has got to serve all kinds of users, and you cannot ever pull all of the transport implications over into this food agency.

So, I would like to see the Government begin with the first proposal made by Mr. Jaenke. I would like to see the Congress seriously consider the third alternative. It is rather difficult for me as a sometime bureaucrat, to see how alternative two could be made to work.

Mr. BROWN. Mr. Soth.

Mr. SOTH. I have been watching changes in Government organization for quite a, few years, and I take a pretty cynical view about just shifting agencies around. I am not very sanguine about any organization of this kind, any of the three, that is very useful. I would rather concentrate on the kind of policy you want to achieve and to set up a planning organization in the Department of Agriculture. And, as Dr. Cochrane and I said in our paper, just on the matter of intelligence information, let us make minor adjustment within the present system to try to make it work better rather than reshuffling of agencies.

Mr. BROWN. Did you have a comment, Dr. Tweeten ?

Dr. TWEETEN. I feel strongly that farmers and consumers need to improve communication. Farmers have been upset in the last few years by actions which they do not favor, and which they feel have been imposed upon them by consumer interests. They feel that agriculture policy has gotten out of their hands. I think from the consumers point of view there is also a good deal of distrust.

Greater communication between farmers and consumers is needed in policy formulation, so that when farm legislation reaches the final stage consumer interests do not suddenly emerge and say: "We do not want this." This opportunity for communication and dialog ought to be possible within the agencies that formulate food policy. It would help educate both the farmer and the consumer, neither of which appreciates the other's point of view.

Mr. BROWN. Do you want to respond, Mr. Jaenke ?

Mr. JAENKE. I think it is naive to think that—light of the emerging importance of food as an important economic factor domestically, as an important economic factor worldwide, and as a tool in our international structure and in the complex of international affairs-h think that the Department of Agriculture by and of itself is going to be able to make isolated decisions. I think what we showed here, the Executive Office Organization for Food Issues chart, and the 26 Government agencies that in some way or the other have gotten into this food problem, is not because people wanted it to be that way. It just happened that way. It developed because of its importance. AID has got a role in food. State has a role. Treasury has a role. Federal Reserve, et cetera.

Right now we have compartmentalized, divided decisionmaking, scattered around all over. In order to tackle this our Government set up some White House structures. These expanded and expanded until we have committees on top of groups on top of boards, I think all three, four, five, or six of us here to today are saying roughly the same thing, that we have got to get on top of this total food picture.

I do not think you can do so short of some single coordinating decisionmaking body with all the information and all the facts. Whether any one of these three alternatives have great preferences or not is really less important than the point that we have got to get all facets pulled together. And to say that the Department of Agriculture can do it or the Department of State can do it or farmers can do it or consumers, is ridiculous. The decisionmaking process must be pulled together to bring about some long-range planning and some coordinated efforts in this area.

Mr. BROWN. Do you want to pick upon that, Senator?

Chairman HUMPHREY. Yes.

Mr. BROWN. He said long-range planning.

Chairman HUMPHREY. We need long-range planning in many things. I have introduced legislation to set u a White House coordinator to pull together the many facets of food policy. We have a school lunch program, the WIC program and the supplemental feeding program, among others. Then we are faced with the policy arguements that take place between Departments of Treasury State, and Agriculture. The most recent example is the so-called voluntary embargo on 'the sale of grains to not on y the Soviet Union but elsewhere. I think some structural reorganization is in line.

By the way, yesterday at our OTA meeting, we approved a series of proposals for further study, such as on the technology of food processing. Another approved assessment is on alternate national food policies and a third one is on the normative function of food grading.

Mr. Jaenke, is the legislative authority for dealing with threatened food shortages or occasional surpluses adequate for supplementing our free market system ?

Mr. JAENKE. No, sir. The current legislation, Senator, the Agriculture Act of 1973, has 'had one major—major weakness-and that is opportunity for adjustment in the loan and target prices was not able to take effect by law until 1976 and based only on the 1975 cost conditions. Since mid-1973, there has been somewhere around a third—a 33 percent-increase in the cost of inputs. But in 1976 because of the wording of the law, this will reflect itself- for the first time as probably an 8, 9, 10, or 11 percent increase at the maximum. So, from that standpoint, it is not adequate.

Second-and 'Congressman Brown brought this out very well in a question he asked of us-is there a way in which we could use the basic concept and add Willard Cochrane's idea of a 3-year average? Basically yes, but I think maybe we have a little difference as to how wide should be the range in market play. I personally favor more than the 10 percent that was suggested in one of the papers.

But the 'basic concept of a loan level with a target price, coupled with some reserve legislation, coupled with some overall policy coordination in the information sense and in the international sense, then I think we can move ahead into the next decade with some confidence and some ease.

Chairman HUMPHREY. I have introduced a bill similar to that. I want you to actively support it, Mr. Jaenke.

Mr. JAENKE. What is that number, sir? [Laughter]

Chairman HUMPHREY. Our problem with this sort of thinking is in the Committee on Agriculture. I happen to think that if you just let it run wild, the producer ultimately gets a poorer deal than he would have if there was some market stability.

From the consumer point of view, once those prices go up, they just do not come down. Just this morning I said to Mrs. Humphrey, "HOW much did you pay for that bacon?" because she only gave me two strips of bacon and I like three. You know, I was just kind of edgy in the morning, and I said, "HOW come I did not get three strips of bacon?"

And she said, "Do you know what the price of bacon is?"

I said, "No, I do not. I know the price of hogs has gone down."

And she said, "Well, you go tell that to all your Senator friends up there, will you." I was getting motherly and wifely advice in the morning. That is the way that day started.

And I said, "Why, I was just out home. I saw that hog prices had gone down about 40 percent since August."

She said, "You go over to the supermarket and see what bacon prices have done." She said, "This bacon cost $1.99 a pound. This is the cheap bacon." And she said, "The other bacon is $2.26, $2.19."

I said, "That is what you told me 2 months ago."

She said, "That is right. It has gone up since then."

I said, "In the meantime, the price of hogs has gone down."

Is that right, the price of hogs has gone down, Lauren?

Mr. SOTH. That is right.

Chairman HUMPHREY. My wife did not *understand* that, and she told me to take it up with you fellows. But is it not a fact that once those prices go up, they stay there a long time in the supermarket? In the meantime, the producer is caught in the ups and downs of the childlike fever of price fluctuation.

How do you think you can sell that to the farmer?

Dr. TWEETEN. In all fairness to the marketing sector, we must recognize that they did absorb some of the price increases at the farm level back in 1973 and 1974.

If you will look at the margin Senator, over a period of years, you will find that this proportion of the consumer food dollar going to the marketing sector tends to be smaller when farm prices ***are*** high and larger when prices are low. It tends to average about 60 percent.

Chairman HUMPHREY. Meat prices have a difficult time finding their way into the supermarket structure. I am a merchant at heart, and I know a little something about inventory. There was not a great deal of pork product in storage. They just did not have it.

I can understand when you buy high, have your warehouses full, you have got to liquidate. But when your warehouses or your refrigeration are at a minimum in terms of supply, this ought to be reflected more rapidly in the finished product.

Anyway, it is hard to explain to your wife.

Mr. JAENKE. We cannot help on that latter one, sir. [Laughter].

Chairman HUMPHREY. It is also hard to explain to the consumer. And I think that farm people have to understand the importance of the consumer here.

Now dairy prices are way up. A pound of butter is over $1. One of the reasons for this is that dairy production is way down and consumption did not drop the way USDA said it would.

If you have an economic policy relating to dairy where you do not worry about the price of feed, where farmers were selling off their cows because they did not want to feed them and where pasture was not too good in many places, you are going to have problems at the consumer level and also at the producer level.

Mr. SOTH. I think that, as you said, when prices shoot up very rapidly, farm prices, that that does tend to get ironed into that retail food cost and it does not come down as much. And, Luther, in that period you are talking about, you did not mention that there were price controls on those margins for a while in that period, and they did not grow as fast then.

But there is a very sticky quality to most of those margins. They stay up once they getup there.

Chairman HUMPHREY. We have had two or three proposals on reserves. As I understand it, Dr. Tweeten, you feel. that a reserve could beheld by the farmer.

Dr. TWEETEN. Yes; I say that because it is one way of getting a reserve policy acceptable to farmers who now oppose establishment of a reserve policy.

Chairman HUMPHREY. I understand the farmers' concern about a reserve policy.

I have made a proposal using about the same figures that you outlined--45 million tons of feed grain, about 500 million bushels of wheat, 150 million bushels of soybeans, and 150 percent release price of the target price.

I was interested in your proposal of a fee for the farmer storage. My reposal would have one-third of that held by the Commodity Credit Corporation, and two-thirds of it held on the farm. My proposal suggests 2-year nonrecourse loans, for example so that Commodity Credit Corporation could not demand that the stocks be brought on into the market, and the farmer could market when he feels conditions are best.

I would like your comments on any of this.

Dr. COHCRANE. I would like to comment on that last point. Those numbers that you and Dr. Tweeten have been talking about, intuitively sound pretty good, and I have used numbers like that myself. In fact, I used to talk about such numbers in the Department of Agriculture between 1960 and 1965. But you have got to recognize that in using those figures, we are the leading exporter of grams. We are linked absolutely, completely, and irrevocably now to the world market, Therefore, you have now got to talk about the #reck that will be required to stabilize the world market, and those numbers I think will not do that. U.S. reserve stock, those numbers have got to be viewed as a part of an international reserve stock program. I think that is very important.

I also agree-and I see no reason why—that a art of the stock could not be held by farmers. I know as well as anybody in the room how much farmers like to hold stocks and get the storage payments. That is fine. But you have also got to recognize that the release and acquisition rules must be integrated into the international reserve stock program. So, we can talk about a reserve stock program and a food and agriculture policy for the United States, but we have got to continually visualize this stabilization program and food and agriculture policy of the United States as being consistent with international programs because the price instability problem arises largely outside the United States, and the long-term trend problem, however you visualize it, arises largely outside the United States.

So, these numbers you are talking about could well be the U.S. share of an international grain reserve, but you should think of them as the U.S. share of the international reserve rather than just numbers by themselves. And you have got to visualize the operating rules for acquisition and disposition as being integrated into the decision rules of the intentional reserve stock program.

Chairman HUMPHREY. Dr. Tweeten.

Dr. TWEETEN. Prior to 1973, and I do not have data more recent than that, the biggest shortfall of grain production before the 10-year trend was in 1965 when it was 44 million tons for the whole world. A reserve of 60 million tons-and that is roughly what we are talking about for grains-would handle about all but perhaps one out of a hundred possibilities. I do not think we would want to hold more than that on the average.

Furthermore, I am pessimistic about soon signing an international food reserve policy, and I think from a humanitarian standpoint as well as for our own self-interest--because this 60 million tons works out from an economic point of view to be ideal for us. The United States should establish a food reserve system.

Mr. SOTH. The Canadians, I believe, are interested in talking with us about a joint United States-Canada reserve program. I recently talked to a couple of Canadians, and I get the impression that the Canadian Wheat Board would be agreeable to at least an international reserve program to that extent, of Canada and the United States, the two biggest exporters.

Chairman HUMPRHEY. That would be a great help, and it is the sort of thing that we need to explore. We will undoubtedly be working with some of the gentlemen here, will we not, Mr. Cordaro?

Mr. CORDARO. We certainly will.

Chairman HUMPHREY. Ed, you were going to say something. Did you have a comment?

Mr. JAENKE. I think it has been said.

Chairman HUMPHREY. I have some questions that we will submit to you for further comment.

Let me just say that I think what we have discussed here is of immense importance. We are going to try to share this information as widely as we can with our colleagues. I am going to take the liberty, Congressman, of putting these statements in the Congressional Record.

I think this is of such basic importance that we must attract more attention to it.

We really need one of these weekends, Dr. Cochrane, that you and I talked about earlier this summer.

Dr. COCHRANE. Yes, what happened to that lost weekend?

Chairman HUMPRHEY. I do not know. That lost weekend got lost, I guess. It seemed to me that it would have been of great value to have an Airlie House-type conference where we could get enough people together to look at the dimensions of the problem before us, and discuss what tools we have to deal with the food problem and what initiatives need to be taken. The food element in our economy is of tremendous consequence, as is the international situation.

How many of these countries that we do business with really have a free market operation?

Dr. COCHRANE. Almost none.

hr. JAENKE. Practically none.

Dr. COCRHANE. None.

Chairman HUMPHREY. I am not opposed to our free market operation. I want to make it operate. I will be honest with you. The longer I am in government, the more concerned I am about what government tries to operate.

I do not want the Government to get into too much marketing.

What is the effect on our system of these Government-managed markets abroad? What does it do to us in our marketing operations? Do we need to make any basic changes in our system of marketing so that we can do a better job for our producers? After all, the main thing we are concerned about here from the economic side is the producer and' the consumer.

Mr. JAENKE. I do not think there is any doubt we are at a tremendous disadvantage. It is like boxing with one hand tied behind you There is no question about it. The informational aspects, of course, come first and foremost. Everything in this count is published. The Chicago Board of Trade, the Kansas City Boar of Trade, and so forth are set up to broadcast marketing conditions around the world. The intelligence network of foreign governments in this country is extremely able in knowing about our domestic grain situation, perhaps as good----

Chairman HUMPHREY. You do not need to compare it with ours. Ours has been dismantled.

Mr. JAENKE. Very good at least. And clearly there is a tremendous disadvantage for American businessmen and cooperatives to try to compete and compete effectively in the world markets against the monolithic state trading system, as you have in Japan, you have in Russia, you have in the EC countries, you have in the developing nations, you have as we said, just everywhere. It is tough.

Chairman HUMPHREY. There are no major countries that have this sort of free market operation in their agricultural sector. Am I correct ?

Mr. SOTH. We are the shock absorber.

Chairman HUMPHREY. SO, we take all the shock of the instability; is that correct ?

Mr. JAENKE. Sure.

Chairman HUMPHREY. Does it in any way jeopardize our capacity to be competitive? I suppose not because we have so much and others have so little.

Mr. JAENKE. We take a beating. The stories of the "Great Grain Robbery" in 1972, the prices that grain sold for earlier in the year because the U.S. marketing system was not able to react fast enough—our Government agencies were not coordinated enough to do it-and' some very, very fire sales prices were obtained by the U.S.S.R. and other countries that were dollars out of every American% pocket, not just, farmers' pockets.

Chairman HUMPHREY. Sweden has become an exporter of wheat during this past year, I understand. Have we lost any markets because of the embargo?

Mr. SOTH. No.

Chairman HUMPHREY, We ultimately have not; is that correct?

Dr. TWEETEN. I would disagree with that.

Mr. SOTH. I do not see how we have.

Dr. TWEETEN. We have lost soybean markets. Japan is making a tremendous effort to develop soybean production elsewhere, primarily in Brazil. We have lost corn markets. The Japanese are developing cotton and corn production in Thailand and other places.

Mr. SOTH. We are exporting more than we should anyway.

Dr. TWEETEN. Over a long period of time export embargoes hurt us very badly.

Chairman HUMPHREY. Dr. Cochrane.

Dr. COCHRANE. What embargo are we talking about, the one that was on for 6 weeks or a theoretical one? Japan has been trying to develop alternative sources of corn production for 10 years. The effort to build Brazil into a soybean producer has been going on for 5 years. These actions are not tied to the last embargo on the Soviet Union. Sure, we are going to have competitors.

Chairman HUMPHREY. Was it not tied to the embargo in 1973?

Dr. COCHRANE. It had some effect, sure.

Chairman HUMPHREY. The Japanese have to have soybeans like they have to have oil.

Dr. COCHRANE. The 1973 embargo really did scare them, and it put them in motion. But this last embargo has had almost no effect on anybody, or anything.

Dr. TWEETEN. But the important point here is not necessarily the embargoes but the very threat of embargoes. You do not have to put on an embargo. All you have to do is make it known you are willing to embargo if things appear to be unfavorable.

The Japanese are a little bit more determined. They have been developing literally millions of acres of soybeans in Brazil. Is that not a fact?

Mr. SOTH. Yes, and we ought to encourage them. Our problem is not whether we can sell our export surpluses m competition for the export market. Our problem is to increase total world food production.

Chairman HUMPHREY. I think you can do both, but I do not want to lose a market if we don't have to.

Mr. SOTH. Should we not encourage agricultural development elsewhere in the world?

Chairman HUMPHREY. Yes, very definitely.

Mr. SOTH. Including Brazil.

Chairman HUMPHREY. Yes.

Mr. JAENKE. But not for the reason, Lauren, that they have been tricked and misled by U.S. Government actions a la embargoes. We ought to be encouraging development of food around the world for different reasons than the embargo of soybeans.

Mr. SOTH. I am not in favor of trickery, no. [Laughter.]

Chairman HUMPHREY. I am glad to see that you plowed against that.

Is there anything else that you would like to add? How about any of your associates, Mr. Jaenke ?

Mr. BATES. It has been pretty well covered.

Chairman HUMPHREY. This has been a very informative hearing. Thank you very much.

[The hearing was adjourned at 12:57 p.m. to be reconvened on February 4, 1976.]

FOOD INFORMATION SYSTEMS

WEDNESDAY, FEBRUARY 4, 1976

CONGRESS OF THE UNITED STATES,
TECHNOLOGY ASSESSMENT BOARD,
OFFICE OF TECHNOLOGY ASSESSMENT,
Washington, D.C.

The Technology Assessment Board met at 3 p.m., pursuant to notice, in room 457, Russell Senate office Building, Hon. Hubert H. Humphrey (member, Technology Assessment Board) presiding.

Present: Senator Humphrey, Senator Kennedy, Congressman Brown.

Staff present: Mr. Emilio Q. Daddario, director; Mr. Daniel V. De Simone, deputy director; Mr. J. B. Cordaro, food program manager; Dr. Walter W. Wilcox, consultant: Ms. Ellen Terpstra, research associate; Ms. Ann Woodbridge, administrative assistant.

Mr. BROWN. The meeting will come to order.

Senator Humphrey has been slightly delayed and has asked that I insert his opening statement in the record at this time.

STATEMENT OF HON. HUBERT H. HUMPHREY, A U.S. SENATOR FROM THE STATE OF MINNESOTA

Chairman HUMPHREY. This hearing marks the conclusion of a series of hearings held by the Office of Technology Assessment on the adequacy and timeliness of food, agriculture, and nutrition information systems. The OTA food assessment group began work on this subject at my request early in 1974. In preparation for the 1974 World Food Conference, the initial results of this study were instrumental in the U.S. delegation's preparation of a proposal of a global early warning and food information system. This initiative was endorsed by the Conference, and work is progressing to implement this system.

Last September, the first hearing was held on the adequacy and timeliness of food information systems. At that time, we heard testimony on improvements needed in U.S. Department of Agriculture agencies and on the progress made recently. m obtaining reliable data from the Soviet Union, the People's Republic of China, and the Third World nations, and the progress made by FAO in creating their early warning system.

At the second in the series of hearings, witnesses discussed the information requirements of alternatives for a U.S. food policy. This hearing explored proposals for a more pragmatic and a more consciously planned approach to developing and implementing U.S. food policy. The two most significant elements brought out in that session were: (1) The need for the United States to improve its resource management activities and policies from input requirements to farm production; and (2) the need for the United States to be equally concerned with the postproduction elements of the food system, especially those which affect nutritional status and health of consumers.

Today's hearings will deal with two to topics: The potential uses of advanced technologies in agricultural in information systems and the recommendations from the OTA Food Advisory Committee for improving the quality of agricultural and nutritional information made available to congressional decisionmakers.

Over the last 5 years, many refinements and improvements have been made in remote sensing technology. Remote sensing is a process of photographing measurements of light reflected off the Earth's surface and analyzing this data with computer systems. By combining this analysis with meteorological, climatological and historical data, it is becoming possible to more accurately monitor and forecast crop production. Additional information can be gained, for example, on soil moisture levels, the spread of plant disease, and water resources on a global basis. By supplementing computer models and digitized information from aerial and ground holographs with remotely sensed data, a more accurate estimate often world's resources can be made.

The first Earth resources technology satellite {ERTS], now called Landsat I, was launched in 1972. Landsat II was launched a year ago.

In the first application of this technology in the agricultural area, NASA, with the assistance of the Earth Resource Observation Systems [EROS] program, the U.S. Geological Survey of the Department of the Interior. and the National Oceanic and Atmospheric Administration of. the Department of Commerce, is cooperating with the Department of Agriculture in the large area crop inventory experiment [LACIE].

In the first phase of the experiment, which has just been completed, USDA used Landsat capabilities to monitor the production of wheat in the United States to see if the current reporting and forecasting systems could be made more accurate and timely.

our first panel of witnesses today includes representatives of the Federal agencies involved in this project. They will discuss the progress made in applying remote sensing and other related technologies. Their review will help us understand both the potential benefits as well as the Policy and technical obstacles to utilizing these technologies.

As Dr. Fletcher. Administrator of the National Aeronautics and Space Administration, notes in a paper prepared for this hearings

> A world agricultural information system is a fairly revolutionary undertaking in that it requires the rapid acquisition, processing, and analysis of objective crop information data gathered on a global basis. Such a system is possible if current and developing remote sensing satellite techniques are used together with traditional systems and techniques.

Dr. Archibald Park of Earth Satellite Corp. has been working with FAO in implementing Resolution 16 of the World Food Conference.

In a paper prepared for this hearing, Dr. Park discussed the technical Imitations and developments and the policy problems of gathering and utilizing data collected on other nations. He says:

There is a very real concern on the part of many countries about the legal and institutional issues raised by an international food information system. Even if national sovereignty were not an issue, the protection of the data would still need to be considered because of the opportunity for unscrupulous speculation in the marketplace.

If we are to successfully implement a global system, we must deal quickly and effectively with these concerns.

To conclude this series of hearings, Dr. Martin Abel, professor of agricultural and applied economics, University of Minnesota, and a member of the OTA Food Advisory Committee, will summarize their report entitled, "Food, Agriculture, and Nutrition Information Systems: Assessment and Recommendations" and additional points made during the previous hearings.

I want to take this opportunity to express my appreciation for the fine report which this committee has prepared and which triggered these hearings. It will be printed in the hearing record. This report makes 12 recommendations for the improvement of food, agriculture, and nutrition information systems. The committee asks Congress to consider the following alternatives to improve their information system by:

(a) Increasing Congress analytical capabilities; (b) eliminating obsolescence and improving the timeliness and reliability of food and agricultural data; (c) improving information on key agricultural inputs such as fertilizer; and, (d) improving nutrition information systems.

Many of these require congressional committee action for their implementation. others could be implemented by the Administration but oversight on the part of Congress would be appropriate and useful.

I intend to ask Congressman Olin Teabgue, chairman of the Technology Assessment Board, to transmit these recommendations to the appropriate committees and urge that they be given their prompt attention.

Mr. BROWN. Our procedure will be to recognize the panel for statements from each of the members, followed by Dr. Park. Then we will have such interchanges as seem desirable in order to get the most from the presentation made by the previous speakers.

The order of the panel that I have, subject to correction from any of you gentlemen, is Mr. Mathews, Dr. DeNoyer, Dr. Hill, and Dr. White.

Is that right?

Dr. HILL. I think I was last.

Mr. BROWN. Dr. Hill should be last ?

Dr. HILL. Yes.

Mr. BROWN. Whatever is satisfactory to you is satisfactory to us. You may proceed, Mr. Mathews. We are very pleased to see you here and have you outline the contribution which NASA is makmg in this area of food, agriculture, and nutrition information systems.

STATEMEMT OF CHARLES MATHEWS, ASSOCIATE ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. MATHEWS. Thank you very much.

The important feature of a space system, of course, is its ability to cover the entire world and do it extremely rapidly. So as compared to other types of information-gathering systems, the satellite system is looked to for timeliness and breadth of coverage.

I think the best way to illustrate that is to talk about something which has reached a high level of maturity-communication satellites.

I think we all understand and appreciate their utility because now telephone communications or television communications can be provided throughout the entire world to nations large and small and can be moved rapidly into place as the need arises.

Communication satellites relate very strongly to agriculture in many ways. We have a very big communications satellite now positioned over Africa, from where it is broadcasting to very small receivers in remote villages in the country of India. One of the chief functions of this cooperative experiment is to provide agricultural-farming type educational information to 5,000 villages.

Some of these villages are very primitive. I have been there myself. They do not at this time have electricity in some cases. The power to run these TV sets is provided by batteries that are charged by bicycle power.

The response to this educational type program has been exceedingly enthusiastic on the pant of these villagers and is producing very marked effects; they continue to ask for educational material as compared to entertainment.

Now, in a very similar way, meteorological satellites have come into being and are serving their useful purposes. We are all aware of their employment for warning of hurricanes and other storms. These satellites now provide very sophisticated information. They can measure temperatures in the atmosphere any place in the world. They provide indications of moisture conditions throughout the world. Furthermore, the information from these satellites, along with ground-based information, is fed into a worldwide network through which information about ongoing weather as well as information to predict the weather is now being provided on a worldwide basis through the auspices of the World Meteorological Association.

The value of weather information to agriculture is obvious: When does the farmer plow ? When does he harvest and so forth?

But in addition to that, agromet—agricultural/meteorological—information, used in certain ways, can be fairly effective in predicting the yield of crops: How much of a given crop is likely to be produced per acre in any particular area of ground.

This is an area that is developing very rapidly and Dr. White, I'm sure, will have more to say about that when he speaks.

Now, the third type of satellite maybe the most important of all as far as agriculture is concerned.

This particular satellite which we call Landsat looks at the Earth and discriminates between various colors, even colors that the human eve cannot sec. T don't want to go into great detail, but it does this an mere at a time and it can do this every place in the world once every 18 days. With this system it is possible to identify crops and measure the acreage in various regions that are associated with particular crops.

Now, the U.S. Department of Agriculture was involved with this idea very early in the game. As a matter of fact they helped us to determine the specifications for the particular satellites that are flying now. Once the first Landsat was up, it was rapidly verified that crops could be identified.

On the basis of this, Dr. Fletcher, the Administrator of NASA, proposed to Secretary Butz in 1973 that a very large scale experiment 'be undertaken to determine the utility of LandSat in estimating the world's wheat production. We are now involved with that experiment. It, is an experiment called LACIE—Large Area Crop Inventory Experiment--and it was initiated in 1974, and includes *not* only NASA and the Department of Agriculture, but also the National Oceanic and Atmospheric Administration. It is a 3-year program. We have completed the first year.

I am sure Dr. Hill from the U.S. Department of Agriculture. will have more to say about LACIE.

In general the results of the first -year are quite satisfactory. Those results were obtained in the Great Plains region of the United States which was chosen as a pilot area because w-e have very good information from conventional sources which will serve as a basis for determining the performance of LACIE. In the next 2 years we will be moving into foreign regions to make similar estimates.

As a result of this, the Department of Agriculture is commencing to establish specifications for a system that could operationally provide global production information, assuming the LACIE experiment works out satisfactorily.

In addition, the Department is working in other areas, such as using the satellite data for help in the domestic estimates as an adjunct to their existing system which indeed is a very good system.

That's a very direct and understandable use of satellite data in the area of agriculture. There are many other important agricultural uses. We can inventory irrigated land. How much land in this country or other countries is under irrigation? We can monitor the change between the rural and the urban and. How much agricultural land is being used up and going into cities and suburbs?

We can monitor the characteristics of water sheds in terms of how they absorb and flow the water. We can monitor the area] extent of snow cover which is very important in terms of water availability, say. in the western part of this country.

We can monitor seasonal variations and range conditions so that cattle or sheep grazing can be regulated. We can also use this in terms of supporting exploration geology in the mineral and energy areas. Energy is as important a consideration in agriculture as it is in everything else.

So it is obvious that many agencies are involved. I don't want to say much more about these uses. I think Dr. DeNoyer will say more about, that later.

The capabilities of Landsat I believe, have met every expectation, but just like everything else, it is possible to provide for improvement.

So we in NASA are now moving to the next generation of sensing capabilities where the performance of the instrument will be considerably improved. For example, instead of being able to look at 1 acre at a time, it will be able to look at one-fifth of an acre at a time.

This means we will be able to survey smaller fields where, for instance, crops like rice are grown. Also, we will be able to get more data on plant stress as well as identification of the crops themselves.

Using radar frequently (microwave) sensors in the future, we will be able to detect and measure such things as the moisture in the soil. We will be able to classify soils. We will also be able to look right through the clouds, something you can't do with an instrument that works at visible or infrared wavelengths.

To return again for just a moment to agrimeteorology, our present basis in the LACIE program for determining the yield of the wheat crop, we feel has indeed been quite satisfactory, Satellites perform an important role in providing this meteorological information, along with the very useful ground information that is also available.

I might say the combination of meteorological satellites and Landsats may be a very good way of identifying promising new lands that are potentially arable; in opening up new lands to increase the world's potential for agricultural production.

Before concluding, I would like to mention one other area that is in its very early stages and that is climate research.

It is very obvious that monthly or seasonal predictions of what is happening to climate are very important to the farmer. Will it be wet or dry this season as compared to last year at this time?

It is also important in a longer term sense, not from the standpoint of whether we are approaching an ice age or something like that again. That's important scientifically. But in terms of considerations such as desertification of arable lands, like those in the Sahel region of Africa, for example, and the reasons behind that and what can be done about it. In fact, the understanding of climate on a regional basis may well enable the return of desert to farmland.

Now, the only way I really know to develop an understanding of the climate program is by means of satellite systems that can measure the radiant energy that leaves the Earth and can measure the incoming radiations from the Sun as it enters the environs of the Earth.

We have systems that are capable of these measurements and we intend to initiate activities in the near future to begin to attain an understanding of this and hopefully a use of this new technology.

So I hope, Mr. Chairman. that I have indicated to you that remote sensing from space is indeed a very powerful tool.

Satellites can handle global problems. Agriculture now is indeed a global problem as you well know.

I think these satellites are certainly a major contributor now to the efficiency of our agricultural activities worldwide.

Thank you very much.

Chairman HUMPHREY. Thank you very much, Mr. Mathews.

[The following report was requested from NASA by OTA.]

REPORT TO THE OFFICE OF TECHNOLOGY ASSESSMENT, FOOD ADVISORY COMMITTEE, TECHNOLOGY ASSESSMENT BOARD, BY THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

A contribution to the Board's Assessment of the Application of Advanced Technology to World Agricultural Information Systems

I. INTRODUCTION

> The lesson of the failure of the food and agriculture information system in 1972-1973 is that we must have more information on food production and market demand in other parts of the world and our analytical capabilities must be increased. *

The management of food supplies is no longer just a problem on a country to country basis. It is a global problem, the dimensions of which have only recently become evident. In order to deal with this problem, better management is needed. Better management is greatly dependent on the acquisition of much better food supply and demand data on a worldwide basis, a system to process and analyze these data to produce useful information on a timely and cost effective basis, and an organization that can use this information to make decisions to alleviate the problem. This is a fairly revolutionary undertaking as it involves detailed and accurate data gathering on an unprecedented scale along with the requirement for systems to process tremendous amounts of data into useful information so meaningful decisions can be made. Traditional systems can contribute to the solution of these problems. But traditional systems were designed to cope with traditional problems, which the international food crisis is not. To be effective, contributions from new systems will be required. In this report, we will describe new systems that can address major requirements for:

1. Worldwide, standardized data collection relating primarily to food supply, but also to food demand;
2. Rapid data processing; and,
3. Accurate data analysis.

These techniques involve the use of remote sensing satellites to provide large area, worldwide, repetitive coverage to monitor changes in agricultural crop acreage as well as weather conditions affecting agricultural field. These satellites utilize advanced sensors which gather data in the most effective regions of the spectrum (the visible, infrared and eventually, microwave wave lengths), not just the visual wavelengths to which cameras are essentially limited. Another advantage of these sensors is that their data can be produced in digital form, permitting rapid processing and analysis by computer. This is essential both for handling the large volumes of data acquired and also to get the most information out of the data. With the marriage of the satellite sensor and computer, and in conjunction with traditional techniques, a worldwide food information system is possible.

In this report, we present an overview of the total spectrum of current programs in which NASA is involved and a look at future developments currently in the planning stage.

At the present time, the satellites primarily being used for such purposes are Landsats-1 and -2; the information they provide include: acreage devoted to agriculture both in the U.S. and within other nations, soil classification, the encroachment of urbanization on agricultural areas, water demand (irrigation), water supply (snow cover), the carrying capacity of range land, and demography. The Large Area Crop Inventory Experiment (LACIE), uses data from these satellites, and from meteorological satellites and existing worldwide meteorological ground data systems, in an experiment aimed at improving global crop production estimates by the USDA Foreign Agricultural Service. LACIE will provide estimates of wheat production in the major wheat producing regions of the world. LACIE has already made estimates of wheat production in

*Quote from the Report of the Food Advisory Committee, June 19'75, p. 40.

the United States great plains area which compare favorably with USDA/SRS official estimates. LACIE is described within this report as well as several other current projects applying satellite technology in food-related applications.

Also discussed is our current thinking concerning future satellites and their more sophisticated sensors such as the Thematic Mapper which will provide better information, particularly for crops grown in small fields. Major contributions to yield information are also expected from meteorological satellites.

Also of great importance to our ability to cope with food management problems of the future is an understanding of the effect of climate on food production and the effect of man on climate. Well documented, but imperfectly understood, changes in seasonal weather patterns since the 1960's, have spotlighted an urgent national and international need for a climatic research program and for the development of a climatic forecasting capability. Because of the capability of satellite systems to provide large-scale synoptic views and to acquire the type of data to assist in understanding and predicting climatic changes, NASA is strongly pointing towards an expanded climatic research program. This also is touched upon briefly in this report.

Our initial efforts in food-related activities convince us that space-based technology has much to offer as we tackle the formidable problems of the future.

II. CURRENT PROGRAMS AND CAPABILITIES

In this section of the report, we will describe some of the food-related activities underway utilizing satellite remote sensing data. Sub-section A is devoted to the Large Area Crop Inventory Experiment (LACIE). Other current activities are discussed in Sub-section B.

A. LARGE AREA CROP INVENTORY EXPERIMENT (LACIE)

The current world food shortages and fuel and energy scarcity with their negative impact on future food supplies has focused worldwide attention on the U.S. in its role as the major exporter of agricultural commodities and has created a greater need both here and abroad for more accurate and timely knowledge of current and projected world crop production. This information is required in planning and affecting crop production and distribution. Exports to other countries, possibly involving millions of tons of grain, could be more effectively planned with less disruption to domestic markets and with better general economic effectiveness if world crop production could be reliably estimated more in advance and on a continuing basis. Planting, marketing, aid, and transportation decisions in producing countries are all based on crop inventory information which is often available only after harvest and is frequently of uncertain accuracy in many countries. Also, crop disasters can occur anywhere on the globe and such events must be made known in a timely way and as accurately as techniques and resources permit.

A crop inventory system utilizing remote sensing technology and the global meteorological system appears to offer great potential for upgrading existing information-gathering capabilities and for contributing to a long-range solution of the food supply problem. The launch of the first earth resources technology satellite (ERTS-1, now called Landsat-1) in 1972, and the results of subsequent experiments utilizing various remote sensing techniques including the digital analysis of multi-spectral data collected by ERTS-1, indicated that applications supporting the U.S. Department of Agriculture's (USDA) information needs in the area of crop production reporting, were feasible. Based on these results, a close working relationship was established between the National Aeronautic and Space Administration and USDA for the purpose of exploiting Landsat technology.

1. LACIE---WHAT IT IS

As a result of progress made In Landsat-based technology and in the use of agrometeorological modeling by NOAA and others to predict crop yields, three agencies of the United States Government (USDA; NOAA of the Department of Commerce: and NASA) designed a specific project to test these technologies in a large-scale quasi-operational undertaking called the Large Area Crop Inventory Experiment (LACIE). A memorandum of understanding among the three agencies was signed in November 1974. LACIE is intended to demonstrate the capability of relatively new remote sensing techniques and data processing systems in combination with more conventional techniques and historical data to forecast the production of an important world crop. LACIE will utilize data gathered by the Landsat earth resources survey satellites in conjunction with meteorological and climatological data gathered both by satellite and conventional techniques. Wheat was selected as the test crop for the LACIE demonstration. The objective is to provide global wheat production forecasts with an improvement over existing methods in terms of accuracy, timeliness and objectivity.

LACIE will extend over three global crop years; the early phases will concentrate primarily on the wheat growing regions of the United States. Then the experiment will be extended to include other major wheat growing regions of the world.

2. LACIE TECHNICAL BACKGROUND

(u) Identification of Crops

NASA Landsat satellites have the capability to view each area of the earth once every 18 days. An electronic sensor carried on the satellite measures the radiant energy reflected from the earth's surface in four different wavelength bands. Two bands measure visible light radiation and two measure infrared radiation.

Energy arriving at the earth from the sun is absorbed or reflected. The wavelength at which energy is absorbed by the plant for growth is dependent upon the plant type, plant maturity and overall condition. This makes it possible to determine the identity of plant communities by the unique way they reflect energy from the sun.

Just as the eye sees reflected sunlight in visible wavelengths (such as blue, green, red) electronic sensors measure the reflection. Electronic sensors, however, are sensitive to more wavelengths than the eye. They can "see" ultraviolet and infrared wavelengths as well as color visible to the human eye. Electronic sensors can also be made much more sensitive and precise than the eye. The data are obtained in a way to make it easier to use in computers which can be used to extract a wealth of information collected by the sensor and particularly to determine the class of crop (wheat, corn, soybean, etc.) growing in a specific field.

(b) *Prediction of Yield*

The Agro-Met models used in the prediction of yield are simply sets of mathematical equations which estimate agricultural (Agro) yields from meteorological (Met) observations and perhaps other factors affecting the crop throughout its development. The accuracy of yield models depends upon knowledge of plant response to the many possible combinations of weather elements, cropping practices, soil fertility, insect and disease damage, and weed control. Generally, these weather factors are the easiest to include in the model. Although some of the others can be obtained quite adequately from knowledge of historical trends.

3. LACIE--TECHINICAL APPROACH

The approach in LACIE is to estimate the production of wheat on a region-by-region basis. To estimate wheat production, two components of production must be determined: yield, the amount of wheat (bushels, metric tons, etc.) for a given area (acres, ***hectares, etc.)*** of harvested crop, and the areal extent of that crop. Simply stated, production is area times yield. Both of these components, area and yield, are estimated for local areas and aggregated to regional and country levels.

Within a region, the total area planted in a given crop such as wheat and the yield from that area, will vary from year to year. In the total variation, both items, area planted and yield, are important. The area planted will vary as a function of economics, weather at planting time, and governmental decisions. Weather throughout the growing season is the prime factor causing changes in yield from year to year in a specific area.

(a) Crop Area Information

Multispectral scanner data of the selected wheat growing areas involved in the LACIE experiment are received from the Landsats and are processed into computer-compatible magnetic tapes at the Goddard Space Flight Center in Greenbelt, Maryland. The tape reels are shipped to the Johnson Space Center in Houston, Texas, where a computer-assisted analysis of the data is made to identify wheat crops and to integrate the selected sample areas into an overall regional acreage estimate, Such information Will be assembled a number of times during the growing season.

The smallest geographical subdivision for which these estimates are made is an area where similar soils, climatic conditions, and cropping practices usually produce similar wheat crops and yields These small areas, for example, counties in the United States, are summed or aggregated to estimate the total crop area within a larger region. The regions are further aggregated to estimate the total crop area within a country.

The sampled segments measured by the Landsats are also combined with historical patterns for a large area such as a country to obtain the total area currently planted with a specific crop. Historical patterns of crop acreage, cropping practices, and planting trends are well established for agricultural regions. The use of sophisticated sampling strategies makes it possible that only 5/10,000 of the total wheat growing area surveyed is actually subjected to detailed analysis including human interpretation. This is described in Figure 1.

(b) ***Crop Yield Information***

Yield is directly associated with weather, soils, and agricultural technology and damage factors. The soil moisture at the time of planting, the rainfall during the growing season, and the temperature are the main weather factors. Agricultural technology includes such things as improved varieties of hybrids, fertilizer usage, insect and disease control, and irrigation.

As already mentioned, agro-met models are used to estimate agricultural yields based upon a knowledge of historical trends and current meteorological observations. Model development work is done at NOAA's Environmental Data Service Center for Climatic and Environmental Assessment (CCEA) at Columbia, Mo. Weather observations are collected daily by NOAA. Rainfall, temperature, etc., are measured from the ground only at certain points, while crops of course grow continuously over large areas. Therefore, ground sampling of weather permits errors to be induced into the equation. To fill these gaps, the NOAA environmental satellites daily provide total coverage of weather between sampling points.

CLASSIFICATION AND MENSURATION CONCEPT

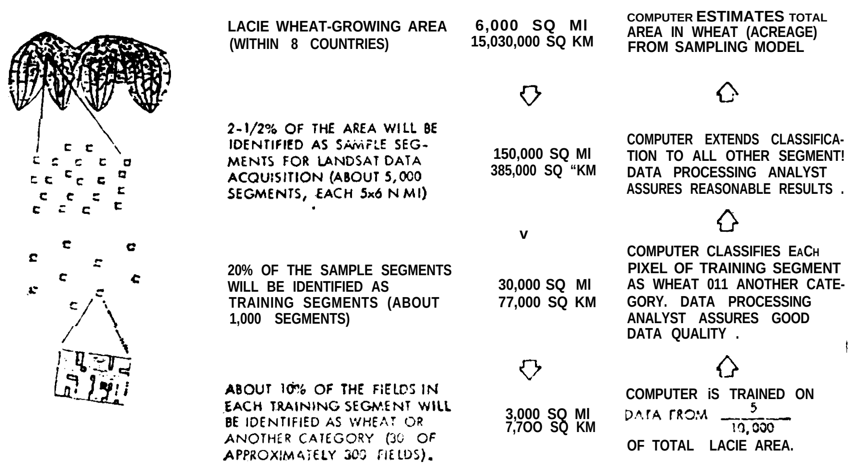

FIGURE 1

(c) ***Output Products***

Products generated as a result of the LACIE analysis are periodic assessments of the area, yield, and production of wheat from specific regions. The wheat assessment reports contain the area of wheat that has been identified as well as the stages of wheat growth and all source data used to derive the assessments. An estimate of the yield will also be included in the assessments. The wheat production estimate will be provided with each assessment, but only the final output assessment will be based upon results after crop maturity occurs across the entire region being reported. Thus, the accuracy of the wheat assessment reports should improve as the growing season progresses.

The Department of Agriculture is the only agency authorized to publish crop reports. USDA studies the utilization of these experimentally derived estimates in its crop reports, which are made public as a routine service to the domestic and international agricultural community. Comparisons are made with conventional forecasts and against actual production on a selected basis.

NASA, NOAA, and USDA publish retrospective research reports for each phase of the experiment that describe in general terms the degree of LACIE success. NASA and USDA publish research results on development of acreage estimation techniques and statistical sampling strategies, and NOAA and USDA similarly publish research reports on the development of their agromet models and on the validity of the derived yield factors.

4. LACIE--STATUS AND OUTLOOK

Emphasis during the first year of LACIE, the 1974-1975 crop year, was placed upon making acreage estimates in the United States Great Plains States, the major wheat producing area of the country. Although LACIE is designed to produce information concerning foreign wheat production, it is important to make estimates also in an area where good standard information already is produced, because that information is used as the baseline against which LACIE performance is evaluated. Data collection for this first year was accomplish as planned, and currently we are assessing the results for those nine states. Data is being collected and analysis has started for the 1975-1976 crop year. In addition to acreage estimates, yield and production estimates will be made during this second crop year. The major area of coverage will remain the U.S. Great Plains; however, Canada will be included, and selected foreign regions outside North America will be analyzed. It is anticipated that during the third year, the 1976-1977 crop year, acreage, yield, and production estimates will be made for all the foreign regions tentatively selected for inclusion in the LACIE demonstration; this will include most of the major wheat producing countries of the world.

Preliminary indications, based upon our initial assessment of the first year's performance, are that the LACIE acreage estimation techniques are generally adequate, and that with incorporation of certain technical changes, desired accuracy goals can be achieved. One of our concerns has been the ability to handle in a routine manner the vast quantities of data required for analysis. This is no longer a significant concern for adequate data handling rates have already been attained. Concentration is now being placed upon improving the estimation accuracies and identifying those techniques requiring further improvement, particularly the extrapolation from one small geographic area to another, a process known as signature extension.

Although the first year's focus was upon acreage, as indicated above, considerable effort has been expended, primarily by NOAA, upon the development and testing of the agro-met yield estimation models and crop calendar adjustment models. The provisions for operating these models with meteorological data from the World Meteorological Organization (WMO) network are complete. All the models are operating as intended, and their design and implementation appear to be quite adequate. In addition, initial attempts to aggregate acreage and yield estimates into production estimates for meaningful geographical areas have been successful.

The new techniques being tested and demonstrated in LACIE, in combination with current crop estimating methods and historical production data, will benefit both producers and consumers by helping reduce the annual uncertainties affecting the management and marketing of major crops. Faster, earlier, and more accurate forecasts should assist in rational planning for the most effective use of supplies, as well as in emergency food distribution both in the United States and abroad.

B. Other Food Related Activities

1. WATER RESOURCES

Agricultural production is vitally dependent upon the availability of water, as the Sahelian drought in the early 1970's vividly demonstrated. Landsat can inventory surface water bodies such as rivers, lakes, ponds and streams and monitor changes over time. Water quality information can be obtained on these water bodies as well, although it is important to have corollary measurements taken at the surface (ground truth) if specific pollutants are to be identified. This ground truth can be obtained through Landsat by utilizing ground platforms with in-situ sensors and relaying the data to a central data collection facility through the satellites' Data Collection System (DCS). This system serves as a communications transponder between the ground sensing Platform, which may be placed in a river or lake to acquire direct water quality data, and a central analysis laboratory.

Landsat data have been used as well to identify rock formations which serve as ground water aquifers in arid regions. This work has been performed in the southwestern United States but the techniques are applicable in other regions.

Other techniques are well under development to measure snow cover and monitor its depletion in the spring. Vast regions in the Eastern and Western hemispheres depend on snow to provide water for agriculture. This includes the direct contribution of snow as soil moisture and also the runoff that can be expected for river flow forecasting and reservoir management. It is expected that in the future water will become a far more scarce commodity and that steps will have to be taken to manage its use more efficiently for agricultural (irrigation) and other uses. Landsat data can make a real contribution in this area.

The foregoing relates to water supply problems, but estimating water demand is also important. A principal requirement for water in agricultural areas is for irrigation purposes. Landsat's contribution here can be in identifying and measuring acreages of irrigated lands, measuring annual changes in these lands, and helping to determine sources of irrigation water and methods of irrigation. This demand information gathered on a regional basis can then be used to project trends important to water supply planning. Steps can also be taken if necessary to try to reduce the demand based on objective information.

For the future, a great deal of effort is going into developing the capability to routinely and accurately sense soil moisture from space. This development should prove to be immensely valuable not only for determining crop yield, but also for planning agricultural practices such as determining optimum planting and irrigation times

2. SOIL CLASSICATION

Proper soil classification is essential for optimizing agricultural production. Yet many nations of the world, including most developing countries, have very poor soils maps. The Food and Agriculture Organization (FAO) of the United Nations has had an extensive international program for years to try to alleviate this deficiency. Yet a tremendous amount of *effort* remains to be done. A number of investigations have indicated the value of Landsat data for this purpose. In one case, a Mexican scientist identified 28 soils groups over most of Mexico using Landsat imagery. Potential land use maps were prepared based on the properties of these soil units and yield production statistics.

Soil classification mapping using Landsat data provided more and higher quality information than previously obtained, even though the previous work had been accomplished with the assistance of the FAO. The techniques are being further developed and used by the International Bank for Reconstruction and Development (IBRD) in an agricultural assistance program with the (government of India. Even in the United States, where soils are relatively well mapped, Landsat has contributed new and valuable information. Remote sensing techniques can be used to provide considerable benefit in mapping soils for agriculture usage in many parts of the world.

8. RANGE MANAGEMENT

The production of beef and most other meat products is directly related to range management decisions which are based on current knowledge of range conditions. At the present time, only gross information based on limited observations and climatological reports is available for this purpose. Landsat–1 investigators from the Bureau of Land Management, the University of Nebraska, and the Remote Sensing Center at Texas A&M have shown that an important indicator of range forage conditions, biomass, can be estimated from Landsat data. In order to be useful, this information needs to be in the hands of range managers within about ten days after it is acquired by the satellite. This is not possible with the present, first generation data processing system. However, we are working to increase our data handling capability in order to meet the required timing. As an example of a promising development in the range area, one investigation in the Great Plains Corridor showed that a correlation between measurements made in two of the Landsat spectral bands (visible red and reflective infrared) and above-ground green biomass and vegetation moisture content could be obtained and appears to be highly promising for range management purposes. Based on these results, a relatively large scale "Wildland Vegetation Inventory Project" is under development by the USDI/Bureau of Land *Management* (BLM) and NASA. One of the objectives of this project is to develop vegetation-type maps, acreage compilations, production estimates and trend indications for rangeland under the control of the BLM The participating agencies are optimistic that positive results will be obtained, which can then be used in even broader area surveys.

4. DEMOGRAPHY

In addition to providing information on food supplies, improved information is needed as well on the demand for food. This demand is a function of population, which is often not well ***known,*** particularly in developing countries. At least one investigation has shown that Landsat data have been useful in Africa to determine the location and size of villages for demographic enumeration. This information was combined with genealogical census data to provide an accurrate assessment of population density. Further improvement in the techniques used is possible and could be of considerable value in future international demographic estimates.

GENERAL COMMENTS

The accuracy of the satellite techniques described above are in most cases dependent on good supporting surface measurements (ground truth). That is, the satellite information generally cannot stand alone without good point source data. The advantage of the satellite is not in replacing the in-situ supporting measurements, but in generalizing these measurements to areas so vast (country or regional scale or larger) that no other known technique can provide the integrating information. The amount of surface measurement data required will vary according to such factors as the application in question, the region in question and the degree of accuracy required.

While very useful results have been achieved to date, there is no question that future satellites with high sensing precision and utilizing additional parts of the spectrum (such as the thermal infrared and microwave) will return data of appreciably greater value.

Since we are dealing with a rapidly advancing technology, both in terms of hardware (sensors, satellites and computers) and software (data analysis techniques, etc.), rapid advances in applications to a food information system can be expected over the foreseeable future.

III. FUTURE CAPABILITIES

At the present time, Landsats-1 and -2 are functioning in orbit. While both have a design life of one year, Landsat–1 will be three and one half years old in January 1976, and Landsat-2 exactly one year old. The two tape recorders on Landsat-1 have ceased to function which means that data cannot he obttained over the many portions of the earth where there are no data readout stations. (There are three stations in the U.S. at present and one each in Canada, Brazil and Italy). In addition, one of the two tape recorders on Landsat-2 has failed, leaving only one recorder to gather worldwide data until the next satellite in the series, Landsat-C, is launched in late 1977. Landsat-C will carry improved sensors in the form of a Return Beam Vidicon (RBV) system with 40 meters resolution as compared with the present SO meter capability, and a fifth "thermal" (heat measuring) band on the multispectral scanner (MSS). These developments should assist in providing a better agricultural field identification capability as well as data for improved crop classification. Landsat-C will also carry two tape recorders to acquire worldwide data. These recorders will have certain reliability improvements over those carried on Landsats 1 and 2.

About the same time that Landsat-C is launched, a small research oriented satellite called the HCMM (Heat Capacity Mapping Mission) will be placed in orbit. Its importance for agriculture is that it will be used to develop techniques to detect soil moisture utilizing thermal infrared remote sensing data. The techniques which are developed will be utilized in conjunction with satellites to be launched in the 1980's.

A. Thematic Mapper

A most significant activity for the future of a world food information system is the development of the Thematic Mapper. It is planned that an improved multispectral scanner-the Thematic Mapper—will be the primary instrument for Earth Resourees surveys after Landsat-C. The Thematic Mapper is to be optimized for vegetation discrimination and for computer assisted analysis.

With a spatial resolution of 30 meters the Thematic Mapper will be able to resolve an area of .2 acres. This compares to the 80 meter 1.2 acre resolution capability presently available with the Landsats-,1 and -2 Multispectral Scanner. Several resolution elements are required to locate and measure individual fields. Figure 2 indicates the minimum size fields that can be resolved with both the Thematic Mapper (TM) and the Multispectral Scanner (MSS) as well as an indication of the field size distribution as a function of country. In addition to locating fields, it is of course also necessary to identify what is growing in the

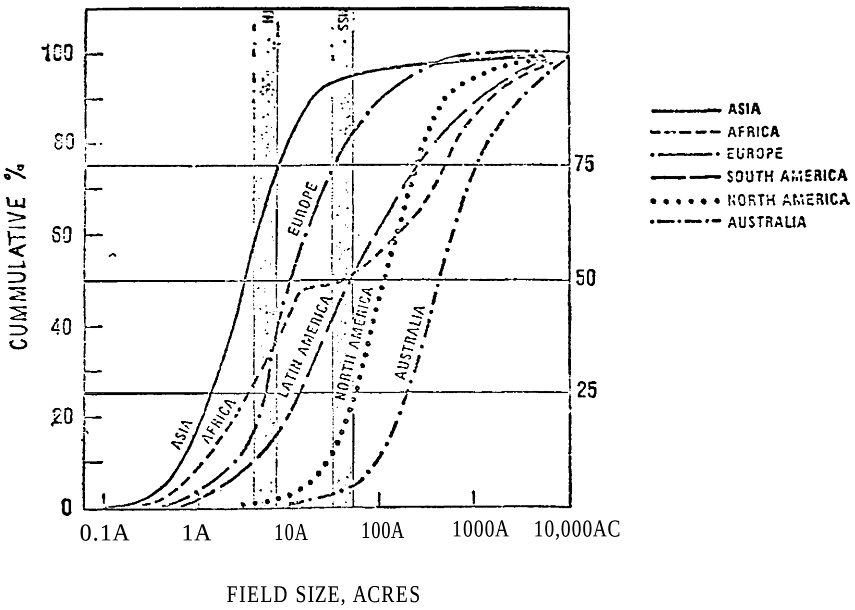

FIGURE 2.—World distribution of cropland fields.

field. The Thematic Mapper will have seven spectral channels (instead of the four bands on Landsats 1 and 2 and the five bands on Landsat-C) that have been selected to meet the vegetation discrimination objective. This, coupled with an improvement in the ability of the instrument to measure small changes in the energy level within each band, will improve the identification of crops by allowing better discrimination among similar crops. This is very important since the Thematic Mapper will help provide the capability to predict the production of major crops, such as rice, that are grown in small fields, and to discriminate among "confusion" crops such as wheat, barley, and rye earlier in the growing season.

A persistent problem in the Landsats-1 and -2 era has been the timely delivery of data to users. To solve this, the Thematic Mapper data flow will be streamlined. Data will be relayed real time via satellite from the Landsat instrument to a ground terminal facility, the TDRS station in White Sands. There, it will be recorded and then retransmitted in near real time via a domestic satellite link to the Landsat data processing facility. The use of such satellite links will allow users to receive data within 45-72 hours of data acquisition rather than having to wait a minimum of seven weeks as presently required.

B. SPACE TECHNOLOGY IMPACT ON YIELD DETERMINATION

The utility of remote sensing technology for yield estimation/prediction has experienced considerable improvement in recent years. The following paragraphs outline the status of present efforts and take a look at plans and future possibilities to better employ the advantages of space technology for managing monitoring agricultural products with emphasis on the crop yield component of agricultural production.

Crops are affected by a variety of environmental factors which eventually combine to produce the resultant yield. The three principal factors are: a) moisture; b) warmth or temperature; and c) energy available to the plant. The following summarizes future space technology developments in these three areas.

1. MOISTURE

(a) Soil mosture

Probably the most substantial advances made to date in this area of endeavor have been those in soil moisture monitoring. Thermal infrared measurements taken throughout the day can be related to soil moisture, i.e., the diurnal amplitude in the surface temperature of soil has been shown to be inversely related to the amount of soil moisture in the upper layers of the soil profile (6 cm). Passive microwave measurements have also been shown to be responsive to soil moisture variations. The most effective band is L-band (20 em). This band has been shown to be responsive even when there are moderate amounts of vegetation present over the soil.

Future spacecraft will be attempting to implement the concepts demonstrated in supporting research and technology programs. For instance, HCMM will measure the diurnal range in surface temperature and relate it to soil moisture. Geosynchronous measurements can and will be used to measure surface temperature variations and relate it to soil moisture. Skylab L-Band and X-band data have already been shown to be sensitive ***to*** soil moisture variation. Nimbus 5. Electrically Scanning Microwave Radiometer (ESMR) measurements have been shown to be sensitive to soil moisture variations over sparsely vegetated regions.

Future spacecraft missions using the Shuttle Transportation Concept will fly large antenna instruments that will provide higher spatial resolution, passive microwave measurements of greater utility to agriculture. Spatial resolutions in the 10 km range are expected. To improve the spatial resolution of microwave systems, the Synthetic Aperture Radar approach is now also being actively considered. Present research indicates 25-100 meter resolution is Obtainable with 4-5 GHz and 7-15° depression angles being optimum. Shuttle systems with this capability can be expected in the early 1980's pending favorable results from ground-based and aircraft flights missions presently being analyzed and planned.

(b) ***Precipitation***

The launch of geosynchronous satellites, such as ATS-1 and 111 and SMS-1 and 2, has provided a means to monitor very dynamic cloud features associated with precipitation event% These approaches can monitor cumulonimbus clouds, cloud turrets, and motions that appear useful for monitoring the location of heavy precipitation and augmenting existing rain gauge networks. These data can be used to augment yield prediction systems employing the moisture budgeting/stress concept and its effect on yield.

Precipitation falling as snow and stored in the mountainous regions of the Western United States serves as valuable stored water for irrigated agriculture. Present satellite systems such as Landsat are measuring snow-cover and this can be used as valuable ancillary data in seasonal snow-runoff prediction procedures. Work is going on to utilize microwave measurements for snowpack moisture equivalent and wetness estimation. At present, the best combination of spectral band measurements is not known. However, multi-frequency microwave measurements on the Shuttle should resolve this problem.

(c) ***Evapotranspiration***

Present satellites (Landsat) can locate vegetated areas, and vegetative density and types within this general category. Making these delineations and monitoring changes with time appears to be a possible tool for separating regions where relative amounts of evapotranspiration are occurring. This concept is under study by the University of California. Additionally, many evapotranspiration techniques require inputs of net radiation. There are indications that key inputs to net radiation estimates may be made from satellites such as reflected solar radiation and emitted long-wave (thermal) radiation. More research is needed, however, in this key area.

2. TEMPERATURE/ENVIRONMENT

Besides the utility of surface temperature measurements for use in moisture estimates and plant stress estimates described briefly above it should be emphasized that this information can be used to indicate susceptibility to pest growth and infestation. The launch of HCMM, Landsat-C, and Landsat-D will enhance this area of endeavor.

Surface temperature measurements will also be useful for monitoring surface freezing conditions that are critical to the citrus industry, for example. Geosynchronous satellite measurement and properly timed polar orbiting, satellite-radiometric measurements will be useful in this regard.

Satellite measurements of snowcover are also useful for monitoring the extent of anomalous conditions such as a *lach* of snowcover and the freezing/winter-kill of winter wheat the extent of hail damage, and the extent of flooding.

8. ENERGY

As mentioned earlier, satellites may offer inputs through direct measurements of reflected solar and emitted radiation or cloud-type identification (for transmission purposes) that give an energy input for plant growth.

G. CLIMATOLOGY

Most of the remarks given above in the discussion of yield determination are associated with assessing the status of the weather or environment at a particular point in time. Probably the most important and challenging area of technology that will improve or contribute to improved agricultural management is improved climatology. The remote sensing program in meteorology is concerned with the causes and effects of long-term changes in climate. It is felt that an assessment of the causes and effects of these changes is necessary in order to assess worldwide shifts of agricultural productivity. The factors which seem to influence the earth's long-term climate are naturally broad in scope and, therefore, amenable to study from earth-orbiting satellites. These factors are:

1. *Variations in the solar constant*. It is believed that variations of as little as 170 in the solar constant can significantly alter the distribution of arable lands. This is because small variations in solar output can have a large effect on energy input to the earth's atmosphere with consequent modifications to weather patterns. Satellite measurements on Nimbus-6 have been monitoring this constant. These measurements will continue, first with the Solar Maximum Mission.
2. ***Variations in the Earth's Radiation Budget.*** Climate is also effected by the amount of energy which is absorbed by the earth's surface. The amount of solar radiation will be determined with a specially-dedicated (Earth Radiation Budget) satellite. Instruments on Nimbus 5 and 6 have been measuring the snow and ice cover which reflects a significant portion of the solar energy. In addition, another instrument on Nimbus 6 is measuring the CO_2 content of the atmosphere, variations in which can result in measurable temperature changes at the earth's surface. The ozone composition is currently being mapped using an instrument. on Nimbus-4. This factor, which determines the amount of ultra-violet radiation which reaches the earth's surface, will continue to be monitored by instruments on Atmospheric Explorer-10 and Nimbus-G.
3. *Distribution of thermal energy*. The air-ocean interface, which plays such a large role in our long-term climate will be monitored by satellites which will measure ocean surface temperatures and current circulations (Nimbus-G and Seasat).

In addition, satellites can contribute through long-term, global or regional measurements of changes in vegetation cover and land use. All these areas are amenable to satellite measurement and will be included in NASA's planning.

A recent paper prepared by V. V. Salomonson and T. J. Schmugge of the NASA Goddard Space Flight Center discusses the important relationship among agricultural meteorology, yield estimation and remote sensing. It is included as Appendix 1 to this report.

D. DEVELOPMENT OF MICROWAVE REMOTE SENSING

The principal advantage of remote sensing in the microwave wavelengths is that microwaves penetrate clouds while observations in the visible and infrared wavelengths do not. Given the fact that a considerable portion of the earth is obscured by clouds at any given time, the development of an aIl weather capability is important. Other advantages are that ***sensing*** can be conducted at night as well as in the daytime; microwaves can penetrate the earth slightly (important for soil moisture determination) ; and, microwaves at certain wavelengths can penetrate vegetation, allowing surface data to be gathered, for example, through a canopy of trees. For these reasons, a high priority is being given to the development of a satellite microwave remote sensing capability for earth resources surveys. Given the fact that microwave sensing is not as developed as sensing in the visible and infrared wavelengths, and that the instrument are relatively large, heavy and complex, it is not expected that dedicated sensors for food information applications will be available before the latter part of the 1980's. When they do become available, they will probably be used in addition to remote sensing at the other wavelengths, and in conjunction with data from traditional systems, to provide an optimum world agricultural information system.

APPENDIX I

AGRICULTURAL METEROLOGY, YIELD ESTIMATION AND REMOTE SENSING

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(I) BACKGROUND

Agricultural meteorology is the discipline in which meteorological principles and knowledge are applied to agricultural pursuits. Ultimately all efforts in agrometeorology point toward the possibility of increasing yields. The purpose of this paper is to explore the utility of remotely-sensed data acquired from aircraft and spacecraft in improving predictions and estimates of yield. A special emphasis will be placed on the prediction of yield for wheat inasmuch as there now is considerable involvement of NASA, NOAA, and the U.S. Department of Agriculture in an effort termed the Large Area Crop Inventory Experiment (LACIE). The purpose of LACIE is to test and demonstrate the capability of relatively new remote sensing and data processing systems, in combination with existing and historical data, to forecast the production of an important world crop: namely, wheat. Production is defined as the product of crop area and yield. While it is conceptually rather easy to see how remote sensing might be applied to measure acreage, the utility and application of remote sensing for estimating and predicting yield is less apparent.

Meteorological factors have a considerable impact on wheat yield and, because of this and as part of LACIE, agromet models employing conventional data acquired utilizing the World Meteorological organization (WMO) network will be developed and utilized as the principal mechanism for estimating yield ***in*** the United States and other countries. There is, additionally, considerable interest in exploring the utility of spacecraft data because it offers a uniform and consistent data set that would provide worldwide coverage and easy access. There is a considerable challenge involved in that it is not readily apparent how meteorological parameters related to crop yield may be estimated or inferred from remote sensing or even how the satellite data should be compiled given the relatively small number of yearn of continuous, computer compatible data that now exist and the high data volumes involved. The rest of this paper will attempt to offer a perspective from which to evaluate the possibilities of utilizing remotely sensed data from satellites and to suggest some approaches using remote sensing that appear to have the most potential for providing useful contributions to improved world-wide wheat yield prediction.

(II) CRITICAL PARAMETERS

‘ There have been several studies conducted which had the purpose of delineating those variables most affecting crop yield and plant response (for example; Thompson, 1962; Thompson, 1969, Williams, 1969). A review of literature shows that the principal variables are moisture, temperature. and energy. Other factors are also involved that include soil type, technological “factors including fertilizer, pest control, and planting practices, and disease or weather hazards. A listing of ‘the parameters that should be considered is given in Exhibit 1.

(III) YIELD ESTIMATION APPROACHES

Estimating or predicting crop yields is a difficult and complex problem. Typical approaches to this problem often involve the process indicated in Exhibit 2. There are several agromet models that have been utilized to estimate crop yields but overall it seems one can identify two main types of models; namely, statistical/regression models and more deterministic moisture balance models.

(A) STATISTICAL MOTELS

The statistical/regression models normally relate temperature, precipitation, solar radiation, potential evapotranspiration, and other variables to yield. Critical to this approach is having a long period of record of high quality, consistent data for a given area. An example of a typical, but very current statistical model is provided in Exhibit 3. This model was developed and implemented by the Center for Climatic and Environmental Assessment (CCEA) In ‘Columbia, Missouri (material furnished by N. D. Strommen, Supervisory Meteorologist, CCEA). The model used here requires inputs of monthly mean precipitation values, values of potential evapotranspiration computed using the Thornthwaite Method (Thornthwaite, 1948), and degree days above 90° l?. Besides Kansas. similar formulas have been applied for Oklahoma, North Dakota, South Dakota, parts of Minnesota, Nebraska, and the Texas-Oklahoma Panhadle area, and Colorado. One may note that the forecast of yield improves steadily as the harvest time for wheat approaches.

(B) MOISTURE BALANCE MODEL

Moisture balance models essentially rely on the fact that plant growth and yield are a function of available moisture. The soil water balance equation can be written:

$$P - O - V - E + \Delta W = O \qquad (1)$$

P is precipitation, O is runoff, V is deep drainage, E is evapotranspiration, and ΔW is change in the soil water storage of soil moisture (Slatyer, 1968).

One of the most critical parameters in terms of crop response and eventual yield is the soil moisture. Many efforts have been made to measure soil moisture directly but still soil moisture measurement are not readily available. As a result, efforts have been made to estimate or infer the amount of water available to plants by accounting for other moisture fluxes as indicated in Equation 1. Precipitation values are readily available with usable observational density. Assumptions or approximate relationships can be used to evaluate the amount of runoff (0) and deep drainage (V) in agricultural situations. The principal challenge in using this approach to estimate the moisture available to crops is in obtaining evapotranspiration estimate (E).

With reference to the use of a moisture balance approach and yield estimates one of the most successful efforts has been that described by Baier and Robertson (1966). The details of applying this approach are provided in Baier et al, (1972). The principal equation used in this method is as follows:

$$E_i = \sum_{j=1} \left[k_j \frac{S_j'(i-1)}{C_j} Z_j PE_i e^{-w(PE_i - \overline{PE})} \right] \qquad (2)$$

E_i= actual evapotranspiration for day i
j= refers to zones in the soil profile
$S_j'(i-1)$ =available soil moisture in the j-th zone at the end of day $i-1$
S_i=capacity for available water in the *j-th* zone
Z_i=adjustment factor for different types of soil dryness curves
PE_i=potential evapotranspiration for day i
“adjustment function for effects of varying ***PE*** rates on the *AE/PE* ratio
k_i=coefficient accounting for soil and plant characteristics
PE=long term average daily PE for a month or season

By monitoring precipitation input and making adjustments for drainage and runoff, Equation 2 can permit daily estimates of E and an accounting of soil moisture that can eventually be related to yield (Baier and Robertson, 1968).

As already indicated, the principal difficulty in using a soil moisture/water budget approach comes in estimating evapotranspiration or with specific reference to Equation 2, potential evapotranspiration (PE). The most analytical formula for estimating PE is that provided by Penman (1948). This formula takes the form:

$$PE=(R_n\cdot\Delta+\gamma\cdot E_{ao})/(\Delta+\gamma), \tag{3}$$

where

$$E_{ao}=0.35\ (0.5+V/100)(e_o-e_a)$$

In this equation R_n is the net radiation at the surface, A is the slope of the saturation vapor pressure curve at air temperature, V is the wind speed, and e_o and e_a are the vapor pressures at the surface and at weather shelter height. This formula requires some data that are not normally available. As a result daily estimates of PE are commonly obtained by regression techniques using standard meteorological data. Use of the regression techniques makes it more difficult to extend the estimates over long distances or times.

In both the statistical methods and the moisture balance methods it is still necessary at some point to regress some variable(s) against yield. At their best, the two methods are roughly comparable in the level of yield estimates that are obtained. The statistical methods are certainly less difficult to implement, but are, in general, less physically related to the growth of the plant. The moisture balance method, even though more complex and subject to error, has been successful because soil moisture is so critical and related to crop response.

(C) PHENOLOGICAL/CROP CONDITION MODELS

One method by which *one* can predict yield is to observe the crop at some time, t_i, and use this as an estimator of its condition at some later time, t+ At. This technique, of course, can be improved by observing the crop at a series of times so as to monitor its rate of growth and maturation and, thereby, estimate its condition at harvest time and the commensurate yield. An example of work where the morphology of the plant is related to its development is provided by Haun (1973) .

A very valuable concept for monitoring crop growth and for relating climatological variables to crop yield concerns the use of the crop calendar concept or the biometeorological time (BMT) concept. When the average data at various stages of crop growth is known and documented the result is commonly called a "crop calendar". This approach is often amplified wherein meteorological variables are used to predict when significant points in crop growth will be reached. Robertson (1968) has used this general approach to establish the BMT concept wherein biometeorological time establishes the rate of development toward maturity as computed from maximum and minimum air temperatures and day length (photo thermal units). For wheat there are six critical BMT stages namely: planting, emergence jointing, heading, softdough, and ripe. There has been appreciable success achieved in averaging meteorological and moisture budget variables over the BMT time periods and regressing the results against yield. The disadvantage of this approach as opposed to using monthly averages, for example, is that more data processing is usually involved. The reason more data processing is involved is that monthly averages can be obtained directly from the National Climatic Data Center in Asheville, North Carolina whereas averages for BMT periods must be constructed from daily data.

(D) CLIMATOLOGICAL MODELS

Many of the techniques just discussed must assume that normal conditions *or* present conditions at the time of the forecast will prevail until the harvest is accomplished. An accurate forecast of the climate to be expected during this intervening period would undoubtedly allow the predicted yield to be much more accurate. In places where data may be difficult to obtain, an accurate climatic model applicable to or encompassing that location or region would permit yield forecasts to be made using the meteorological variables provided by the model. Certainly the value of accurate climatic models cannot be underestimated for improvements in yield prediction and better management of world food resources. However, there is much to be done before reliable, accurate models applicable to crop producing regions is realized. An excellent review of the present state of climate modelling is provided by Schneider and Dickinson (1974).

(E) METEOROLOGICAL EPISODES

Present yield prediction models do not adequately treat anomalous events that severely limit yield or destroy a crop. Such events or episodes would include severe drought, freezing, hail, abnormally heavy rains and wind storms, or diseases. These events are probably best accounted for by having a monitoring system that adequately detects anomalous events, surveys the extent of damage to the crops, and permits an estimate of the effect on yield. A satellite-based remote sensing system allowing repetitive global coverage and thereby permitting crop condition to be monitored should be very appropriate here. This possibility along with other remote-sensing applications in yield forecasting will be described briefly in the next section.

(IV) THE APPLICABILITY OF REMOTE SENSING

As indicated earlier the primary variables that affect yield are moisture, temperature, and energy. The applicability of remote sensing for monitoring these parameters as well as others given in Exhibit 1 is conceptually quite clear in terms of providing high observational density observations on a repetitive basis over large regions. However, it has not been conclusively demonstrated that these parameters can be observed with sufficient accuracy from spacecraft or high altitude aircraft to make this approach a viable tool for yield forecasting, in particular, and agricultural climatology, in general.

(A) REMOTE SENSING---STATISTICAL MODELS

For input into statistical models exact correspondence with conventional information must be established for remote sensing information so that it can be directly incorporated into existing models, or a data set sufficiently large for establishment of statistically viable relationships and yield predictions based on satellite observations must be available. Exhibit 4 provides a summary that primarily describes the availability of digital data on computer-compatible magnetic tapes. Overall, the most consistent, nearly continuous digital data is “atmospheric window” 10-12 urn data obtained by radiometers on the Nimbus series, primarily, but more recently available from the NOAA satellites and from the Defense Meteorological Satellite Program (DMSP). Since these data would reflect variations in cloudiness, surface moisture, and crop cover, there may be a possibility that some useful statistical relationships could be obtained between some function involving satellite brightness temperature (perhaps just a simple average) observed at different points in time during the growing season and crop yield.

Another observation from meteorological satellites that is consistently available since approximately 1966 is cloud cover as depicted in satellite imagery. Because cloud cover is related to incoming energy, precipitation occurrence, and the general climate prevailing in a given area, data extraction and processing techniques involving cloud cover estimates from imagery may offer a viable alternative for improved yield prediction, particularly in regions where data is sparse or difficult to obtain.

Averages of precipitation amounts, net radiation, or incoming solar energy can be substantially in error over large regions because of the wide spacing, low observational density of conventional observations, Huff (1970) describes sampling errors in the measurement of mean precipitation. Existing satellite data, such as that from the Synchronous Meteorological Satellite (SMS) series, should be useful in providing, in conjunction with conventional rain gauges, more accurate mean precipitation input over areas of various size extending from county-sized areas to the state or regional scale. It may also be possible to provide useful measures of precipitation ***over*** data sparse regions using satellite data alone. This possibility has been studied by Follansbee (1973). A general review of rainfall estimation methods from satellites is proved by Martin and Scherer (1973) .

@) REMOTE SENSING---MOISTURE BUDGET METHODS

As indicated previously, the fact that satellite remote sensing observations offer a high observational density capability with which to augment conventional observations suggests that its utility and the accuracy advantages' should be explored. There are many yield prediction models which work at a given location but fail when applied to other areas or over wide regions. These models fail many times because the conventional data input does not adequately reflect the spatial variability of parameters such as precipitation, net radiation, soil moisture, and evapotranspiration. This problem exists not only with the moisture budget models but also the statistical models. The possibilities of providing improved model inputs of precipitation and evapotranspiration estimates using the Penman Equation (3) need to be explored in detail. Some recent work by the Earth Satellite Corporation • indicates that there is potential for remote sensing in this area of endeavor with eventual application in the soil moisture accounting apprеach (Equation 2).

The fact that soil moisture is such a critical parameter for crop growth coupled with the indications that remote sensing can be applied for this purpose suggests that substantial research needs to be accomplished to ascertain the exact applicability of remote sensing measurements of soil moisture. Published results describing the possibilities with albedo data (Idso et al., 1975), thermal infrared (Idso et al., 1975) and microwave data (Schmugge et al., 1974) are available. The fact that microwave data provides a soil profile penetrating and vegetation penetrating capability makes it appear to be a particularly attractive approach to be explored as rapidly as circumstances may permit.

(C) CROP CONDITION MONITORING

There are several studies that indicate the condition of a crop can be observed and perhaps used to estimate its condition at a future time such as harvest. Among the investigators who have described relevant results are Morain (1974), Rouse (1973), and Wiegand (1974). These reports show that by using ratios of Landsat bands such relevant features as leaf area index, biomass, and crops under stress can be observed. The data developed by Dr. K. Ranamasu (Morain, 1974) show that a peak in the value of the (0.5--0.6)/(0.6-0.7) micrometer reflectance ratio is reached approximately 40 days before harvest. The level of this peak appears to be related to wheat yield. The presence of disease, insect festation, moisture stress, and fertilizer deficiency may also be observable from space and used to adjust yield estimates.

(D) METEOROLOGICAL EPISODES

Since meteorological conditions such as freezing, hail damage, or the effects of unusually heavy rains can severely reduce yield and should alter the spectral appearance of crops, the possibility of monitoring the occurrence and extent of these phenomena with remote sensing would be explored. The persistence of snowcover, or below normal, or above normal soil temperature conditions, flooding and other abnormal conditions may possibly be successfully monitored from satellites alone or in combination with conventional observations. There is a ***recognized*** need to do this kind of monitoring and the opportunity for successful monitoring from space platforms seems quite real.

(V) SOURCES OF COMPARISON AND GROUND TRUTH

The most sophisticated crop production forecasting system available today is that applied by the U.S. Dept. of Agriculture Statistical Reporting Service. The average error in yield forecasts is about 2% with the standard deviation in the error being about 8 percent 9 months before harvest (Castruccio and Loats, 1974). These figures apply to national production forecasts. The error increases as one goes to smaller and smaller reporting units. The average error at the state level at harvest is estimated to be 4-6% and the crop reporting district level it is estimated to be approximately 10%. The yield component contributes about 50% of the total variance in production.

The accuracies mentioned above are the standards of comparison for new methods using remote sensing applied in the United States. If comparability between yield forecasting methods employing remote sensing and conventional methods can be established in the United States, these same remote sensing methods should provide valuable information concerning crop yield in countries outside the United States. It should be explicitly pointed out that the first priority goal is to provide national crop production estimates.

● Private communication with Mr. Earl Merritt, Earth Satellite Corporation, Washington, D.C.

For national and state or regional estimates of yield the USDA/SRS estimates serve as a standard of comparison. Because the SRS technique is essentially a small sample technique it cannot serve as a very effective standard of comparison at the crop reporting district and county level. At present there is not clear requirement for accurate yield estimates at the county level, but it may be hypothesized that as food supplies become more critical, and if a Capability for providing such a result can be demonstrated, such information may be quite useful at the local/county level@ improve national and state yield estimates at the same time A remote sensing system may offer this potential but in order to validate such a system accurate ground truth systems are needed. These ground truth systems would provide accurate, local yield measurements, and measurements of soil moisture, precipitation, evapotranspiration, and crop condition that would validate remote sensing measurements and yield estimates employing remote sensing. The LACIE system of ground truth/test sites is a step in the appropriate direction

(Vi) CONCLUSIONS

There is a clear need to improve the ability of this nation and the world to predict crop production and manage food resources. Remote sensing from spacecraft and aircraft appears to offer some opportunities for improvement in yield prediction, but considerable research and data analysis is needed before this apparent potential is substantiated. Conventional methods use readily available data that is relatively easy to process and provide predictions in the U.S. that are comparable to nationwide estimates provided by the U.S. Department of Agriculture. Remote sensing may provide a uniform, consistent data source that can be obtained over all regions without depending on an international network of ground-based stations. It, furthermore, may provide a means of improving model input on all scales by capturing more accurately spatial variability in parameters such as precipitation and net radiation. Additionally, any improvements that are produced must be evaluated in terms of the greater data processing complexity associated with models using remote sensing data as compared to methods using conventional meteorological data.

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EXHIBIT 1

FACTORS IN WHEAT YIELD FORCASTING

PRIMARY		SECONDARY
ENERGY	(Net Radiation, Incoming Solar Energy)	Light (no. of cloudy days}
		Wind (damage)
		CO_2 (Yield *a* CO_2)
WARMTH	(Temperature)	Soil Type
		Date of Planting
		Rate of Planting
MOISTURE	(Soil Moisture, Precipitation)	Depth of Planting
		Diseases, weeds
		Nutrients
		Leaf area and leaf area index
		Variety

EXHIBIT 2

CROP YIELD ESTIMATION

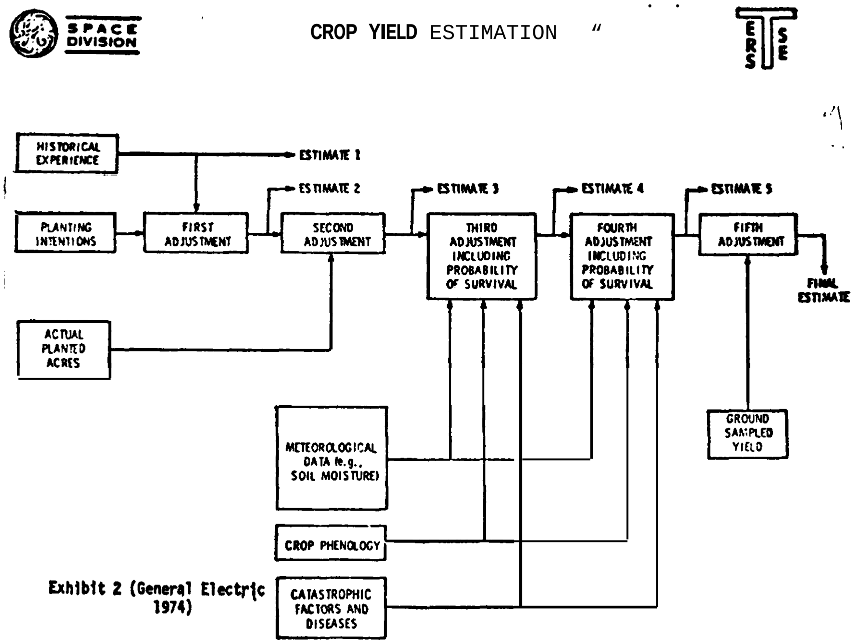

Exhibit 2 (General Electric 1974)

EXHIBIT 3

TRUNCATED MODELS FOR KANSAS WINTER WHEAT (1931-74)

VARIABLE		TIME OF TRUNCATION: TREND	FEBRUARY	MARCH	MAY	JUNE
Constant		10.383	10.471	11.407	13.263	13.347
Linear Trend 1931-55		0.250	0.268	0.213	0.208	0.225
1955-74		0.819	0.741	0.611	0.775	0.759
Aug-Feb Prec. (in.)	DFN	-------	0.521	0.343	0.293	0.284
March Prec.-P.E.T.	DFN	-------	-------	1.875	1.487	1.591
(in.)	SDFN	-------	-------	-0.170	-0.120	-0.139
May Prec. (in.)	SDFN	-------	-------	-------	-0.309	-0.293
May Degree Days Above 90°F		-------	-------	-------	-2.424	-2.453
June Prec. (in.)	DFN	-------	-------	-------	-------	-0.133
	SDFN	-------	-------	-------	-------	-0.119
Standard Error (bu/acre)		3.68	3.48	2.90	2.53	2.48
R^2		0.77	0.80	0.86	0.90	0.91

Standard Deviation of Yields = 7.42 bu/acre

DFN = Departure from normal
SDFN = Squared departure from normal

EXHIBIT 4

DATA AVAILABILITY

SATELLITE	SENSOR	RESOLUTION	DATES	REMARKS
NIMBUS 3	MRIR 6.7 10-11 20-23 12-4		1969 MAY 15 - JULY 18 JULY 20 - NOV. 19 NOV. 22 - 25, 28, 29, 30 1970 JAN. 9 - 11, 13 - 17, 20 JAN. 21 - 16 JAN. 28 - FEB. 4	RELATIVELY COMPLETE DIGITAL DATA VERY FEW HOURS OF DIGITAL DATA SPORADIC AVAILABILITY FAIRLY CONTINUOUS
	HRIR	8.5km (4.6m mi)	1969 APRIL 17, 19, 22 - 30 MAY 1 - NOV. 30 DEC. 23	NMRT DATA
NIMBUS 4	THIR (11.5 μ)	6.67km (4.1n mi)	1970 APRIL 10 - AUG. 31 SEPT. 1 - DEC. 27 1971 JAN. 5 - FEB. 26	CONTINUOUS SOMETIMES SPORADIC *THE FIRST 500 ORBITS OF NIMBUS 4 ARE AVAILABLE IN SPACE SCIENCE DATA CENTER (SS DC)
	(6.7 μ)	22.6km (14.0n mi)	1970 APRIL 14 - JULY 31 AUG. 1 - DEC. 22 FEB. 2, 5, 21, 22, 1971	CONTINUOUS SOMETIMES SPOTTY
NIMBUS 5	THIR (6.7,11.5um)	22km(6.7) 8km(11.5)	DEC. 72 - JUNE 74 DEC. 72 - JUNE 74	NMRT TAPES 6.7 SPORADIC DEC. 72 - FEB. 73, MAY 74 - JUNE 74 FAIRLY CONTINUOUS LATE APRIL 73 - AUG. 73 11.5 SPORADIC DEC. 72 - MAR. 73, APRIL 74 - JUNE 74 FAIRLY CONTINUOUS LATE APRIL 73 - AUG. 73, LAST HALF FEB. 74
	ESMR	25km x 25km (160km Cross Track) (45km Down Track)	DEC. 72- PRESENT	DIGITAL DATA AVAILABILITY IS POOR AUG. 73, MARCH, APRIL 73 AND ½ of AUG. 74
NOAA 2, 3, AND 4	SR	8km	JAN. 73 NOAA 2 APRIL 74 NOAA 3	- NOAA 3 IS BACK UP TO NOAA 2 - DIGITAL DATA ARCHIVED UP TO 1 YR; TAPES RECTIFIED IN LAT. AND LONG.; 1,J SYSTEM POLAR STEREOGRAPHIC ONLY - NEGATIVES SAVED; MAY BE A CHARGE FOR PICTURE
	VHRR	0.9km	SAME	- WALLOPS SAVES ONE WEEK AT A TIME, THEN ERASES. REQUESTS SENT THURSDAY TO HOLD DATA OR CAN PUT IN A CONTINUOUS REQUEST FOR DATA.
SMS	VISIBLE IR	.9km (½ mi) 7km (4 mi)	MAY 17, 1974 - PRESENT	- WESTINGHOUSE, NEAR FRIENDSHIP AIRPORT RECEIVING DATA 24 HRS, 7 DAYS A WEEK. - TO DATE PRODUCTS MOSTLY IMAGERY THOUGH SPORADIC - A TAPE BACK-UP OF ALL DATA - CODE 564 LOGGING IN DATA RECEIVED - PERMANENT LOCATION NOV. 15, 1974 @75°W - AFTER DEC. 1, 1974 PLAN TO DIGITIZE DATA
DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP)	VIS IR	2 mi 2 mi (1/3 mi POSSIBILITY FOR BOTH)	MARCH 73 UP TO ONE MONTH OF PRESENT	- 3 SATELLITES, EQUATOR CROSSING TIMES 0700 AND 1900, 1200 AND 2400 - IMAGERY REPOSITORY UNIV. OF WISCONSIN - DIGITAL DATA - ONLY THE PRECEEDING 4 WEEKS SAVED AT ANY ONE TIME; OFFUTT AFB

Chairman HUMPHREY. I want to apologize for my delay in getting here. We had a battle going on in the Senate.

I recall our association during the days of the Space Council. I am very pleased to have you here.

I gather that we are going to proceed with the witnesses, Dr. White, Dr. DeNoyer, and Dr. Hill Dr. White, would you proceed please.

STATEMENT OF DR. ROBERT WHITE, ADMINISTRATOR, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Dr. WHITE. Mr. Chairman, members of the Technology Assessment Board, it is with great pleasure that 1 appear before you today to discuss the relationship between technology and agricultural productivity as it pertains to the work of the National Oceanic and Atmospheric Administration. Weather and food productivity are so closely related that making a point of it only states the obvious.

The question I wish to discuss today is not what the relationship is between weather and agriculture, but how emerging technology for observing and predicting weather conditions can make our agricultural information systems more effective in increasing agricultural productivity and assist in policy decisionmaking. I would like to talk about three ways in which weather information can be of great value in agricultural information systems.

The first deals with the provision of agricultural weather services directly to the farmer to enable him to carry out his daily tasks with greater efficiency. Advance weather information a day or two ahead can affect the way in which he protects, sprays, harvests, or sows.

The second involves the provision of weather data as part of an agricultural warning and assessment system. Such weather information from our country and others, plus an understanding of the relationship between weather and crops can enable us to assess the impact of the recent past and present weather conditions on crop production, thus generating a basis on which both operating and policy decisions can be taken.

Lastly, there are the problems of climate and anticipating its future changes. An ability to predict changes in average weather conditions over a period of months, seasons, or years could be valuable in alerting us to possible adverse or beneficial growing conditions both in this country and around the world. Such information could be useful in planning decisions on agricultural production, storage of agricultural reserves, food export policies, and preparation of disaster assistance.

New technology can assist us in providing such information. Some of this new technology is available, some requires more development. Improved basic understanding of weather phenomena is essential for all applications.

Let me talk briefly about the agricultural weather service. The provision of daily forecasts of the weather specifically geared *to serve* the farmer is not a glamorous activity, but it is certainly one that can most directly affect agricultural productivity. The fruit frost forecasts for the valleys of California, or specialized forecasts for the corn and wheat growers that enable them to fertilize and spray at the right time are dependent upon one of the world's most comprehensive and complex environrnental-information-gathering systems. The system is worldwide, for we need weather information not only from our own country, but from all countries of the world if we are to predict the weather even a few days ahead.

Weather information is collected by satellites, aircraft, ships, and land stations. These data are processed daily by large computers at the National Meteorological Center in Washington and delivered to our many field offices via high speed facsimile systems. Our field forecast offices tailor these data and forecasts to the needs of farmers in various areas of the country.

One might think that such an important service would be in existence in all parts of the Nation. As a matter of fact, since its inception some decades ago, it has been introduced to about 20 percent of the United States. If we are going to develon agricultural information systems that will increase our agricultural productivity, it will be

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necessary to extend our agricultural weather service throughout the Nation.

Secondly, I would like to talk about a weather warning and agriculture assessment system. By this, I mean a system that enables us to be aware at all times of weather conditions within our country and in other countries of the world, and being able to understand the implications of cumulative weather at any point in the growing season upon the outlook for crops. The Department of Agriculture keeps close tabs on the status of our crops and we work closely with that Department in providing detailed weather information accumulated from our observational networks both here and abroad.

However, new technology offers the hope that we can do this better. Earth-orbiting satellites have great potential. The NASA Landsat which provides multispectral sensing data, may enable us to estimate acreage of crops planted and the state of crops. When combined with the weather satellite information, and other weather information, as well as a knowledge of the relationship between weather conditions and crops, we have a potential capability of great value. At the present time, together with the National Aeronautics and Space Administration and the U.S. Department of Agriculture, we are engaged in an experiment called the Large Area Crop Inventory Experiment [LACIE].

Last, I would like to talk about the problems of climate. World food reserves have now sunk to a point where year-to-year fluctuations in climate can have disastrous effects upon world food supplies with serious economic and political consequences. Is there a possibility of improving our ability to anticipate climate changes better than we can do today? Our present ability to anticipate weather conditions a month, season, or a year in advance is very poor. It is poor because we lack the basic understanding of the causes of changes in climate. It is also poor because we have not had the technology for acquiring necessary observations or processing them.

To improve the national capability for anticipating changes in climate better than we do today, we must bring to bear a new range of advanced technology. If we are to understand and predict natural climate fluctuations, there are some fundamental measurements that we must make.

For example, the climate of the world is related to the state of the oceans. It is necessary for us to have a system for monitoring oceanic conditions. Such a system must be based upon the use of Earth-orbiting satellites which have a capability of measuring sea surface temperatures, sea state, and ocean currents, ships of opportunity that may take highly automated ocean surface and subsurface observations while traveling their normal routes, and automatic buoy technology which can measure the conditions of the oceans at depth. We are experimenting with both of these technologies.

The National Aeronautics and Space Administration has under development an ocean satellite to measure many aspects of the conditions of the oceans. The Seasat, in addition to the Landsat and the environmental satellites of NOAA, offer us opportunities to gather ocean information that we have not had before.

In the case of buoy technology, we have had a research and development program underway for 5 years aimed at providing buoys which can remain unattended in the deep oceans for as much as a year, radio-ing back their information about oceanic conditions via satellite. Our buoy developments are at the prototype stage. During the next year we will deploy a prototype buoy network along our Pacific coast. I cite this only as an example of the opportunities that new technology opens for us in the examination of climate.

Chairman HUMPHREY. Do we still have the marine science operation ?

Dr. WHITE. No, we don't. We do have a committee which I chair called the Interagency Committee for Marine Science and Engineering. NASA and Interior, are represented.

Central to our ability to move forward is the development of a capability to simulate the ocean-atmosphere system by mathematical computer models. For this we will need to move toward new generations of computer systems. In NOAA we employ the largest commercially available computer system. At our geophysical fluid dynamics laboratory we operate the Texas Instruments advanced scientific computer, a so-called fifth generation computer which can execute approximately 40 million instructions per second. We will need to move even larger computers operating at speeds greater than 100 million instructions per second if we are to model the atmospheric and oceanic system and use such models to predict the future climate.

Technology will be important to us also in attempting to monitor and understand the consequences of man's pollution of the atmosphere. The release of substances such as nitrogen oxides, which come from supersonic transports and nitrogen fertilizers, or chlorofluorocarbons, which are used in refrigeration and aerosol spray cans, can affect the ozone.

While we are much concerned about the impact of a decrease in the ozone layer on human health and upon terrestrial and aquatic ecosystems, we have heard little about the possible effects of a decrease in ozone upon the climate of the world. Perhaps it is because we do not understand the consequences, but the ozone layer, because of its special property, is important in heating the stratosphere. A reduction of the ozone can have an effect on the temperature of the upper atmosphere and may consequently influence the lower atmosphere and our weather as well. It is an impact that we need to understand.

There are other human activities about whose effects on the climate we need to be concerned. Burning of fossil fuels adds heat directly to the atmosphere, and it adds car on dioxide. Poor agricultural practices and industrial activities add particulate matter. These and other substances can have an impact upon the atmospheric energy balance and hence upon the climate. We need to understand these effects better.

In order to do so, we are going to need new technology to monitor and measure. We will need satellites and aircraft and balloons. We will need new instrumentation and facilities to measure the rate at which these contaminants are building up in our ocean and atmospheric system.

Weather information must be an integral part of any agricultural information system. We can improve the availability of needed weather information. The key to this improvement is the use of advanced technology.

Thank you.

[The following paper was requested from NOAA by OTA:]

ADVANCED TECHNOLGY IN AGRICULTURAL WEATHER INFORMATION SYSTEMS

EXECUTIVE SUMMARY

Automatic data processing and satellites are now and must continue playing key roles in agricultural weather summaries and forecasts. Both technologies are used in preparing daily advisories and forecasts for U.S. farmers, in agro-meteorological studies, in monitoring and analyzing growing season weather over major world grain producing areas, and in the Large Area Crop Inventory Experiment (LACIE). Automatic data Processing also is an essential tool in developing a capability to interpret long-terrn impacts of growing season weather in terms of variability of future yields.

The National Oceanic and Atmospheric Administration (NOAA) is applying these technologies as rapidly as resources and the state of the art permit. Basic to future progress, however, will be the need for computers of sufficient capacity and speed to handle the large volume of data required to develop adequate global climatic model Such modeling research has begun at NOAA's Geophysical Fluid Dynamics Laboratory at Princeton, New Jersey.

The National Oceanic and Atmospheric Administration (NOAA) uses automatic data processing and meteorological satellite imagery for its weather forecasting services for agriculture, for agrometeologcal studies in support of more effective agricultural Practices, and for developing global weather-yield estimation models.

NOAA National Weather service (NWS) forecasts including agricultural weather forecasts, are based on activities at an extensively computerized National Meteorological Center (NMC). NMC routinely acquires large amounts of cloud and temperature data from weather satellites as well as over 20,000 land-station, ship, balloon, and aircraft observations daily. NMC computers process the raw data and produce weather map analyses, Prognostic charts, and other guidance material such as quantitative Precipitation forecasts for dissemination to NWS field offices and other subscribers. The NMC guidance is disseminated through. more than 600 facsimile and 800 teletypewriter transmissions daily. The centralized preparation of data maps, and forecasts is designed to eliminate ***most*** requirement for hand charting and independent meteorological analysis at field offices. The NWS through combined use of its large computer facility, numerical forecast methods, and its field forecast offices and service centers, provides agricultural and other users with daily forecasts and outlooks out to five days in advance.

Specialized agricultural weather advisories and studies at the state 1evel also use weather satellite data as well as nearby university computer systems. As an example, the Environmental Studies Service Center at Auburn, Alabama has begun a study to use weather satellite data in its real-time agricultural weather service program. It centers on development of techniques and methods providing the absolute radiation temperature at the earth's surface and then incorporating the thermal data into models for Prediction of soil temperature and moisture. In addition, the thermal data will have great utility in improving service in areas where freeze hazards exist. The thermal data will pictorially portray the real-time development of a freeze allowing growers to sharpen decisions in management of cold protection practices. In addition, a "cold night" climatology can be produced which will be valuable in land use planning and in improving "spot" temperature forecasts.

NOAA progress in more timely acquisition of global precipitation and temperature data for cumulative growing-season assessments was described in the fourth and fifth paragraphs of Dr. Edward Epstein's report of September 25, 1975 to the Technology Assessment Board. For completeness I should add that the Air Force Global Weather Central at Offut Air Force Base is working with us to extend and improve the precipitation estimating procedure that systematically integrates conventional meteorological observations and satellite observations of clouds over selected areas of the Northern Hemisphere.

NOAA development of weather-yieid estimation models is a part of the NASA/NOAA/USDA Large Area Crop Experiment (LACIE). The goal of LACIE is to provide prompt (within 14 days of data acquisition) objective estimates of wheat production. NASA and the USDA are concerned with developing experimental demonstration systems, using LANDSAT multispectral data,[1] to determine acre-

1 Data on spectral reflectance of the target of competing crops.

ages of wheat planted in eight nations. NOAA's Environmental Data Service and the USDA are concerned with defining and quantifying the relationship between meteorological conditions and crop yield in the same eight nations.

NOAA weather-yield estimation is accomplished by use of meteorological data routinely available through the World Meteorological Organization communications links augmented by examination of satellite images from the NOAA polar orbiting and geostationary satellites. It is not now possible to obtain quantitative data from satellites on most of the important environmental parameters most affecting crop yields, e.g. soil moisture and solar radiation. Satellite images are useful, however, in detecting areas which remain cloud free (hence without precipitation) for long periods of time resulting in drought conditions. Satellites are also of considerable use in tracking large storm systems over crop producing areas to improve estimates of rainfall or call attention to potential flood conditions. It is our intention to incorporate quantitative data derived from satellites when the data acquisition and processing techniques have been developed.

In our opinion, LACIE has tremendous potential for providing prompt, objective, world-wide information on critical crops. The first year of the program focused on the Great Plains areas of North America. Preliminary results are encouraging. Technical problems in acreage estimation have been identified and, we believe, solved to the point that the three agencies are proceeding with phase two-an 18 month test of techniques for the Great Plains plus selected areas in other nations. Preliminary analysis of the yield estimation system used in phase one is quite encouraging. Phase three will consist of a full scale test on a global scale and is scheduled to start in about a year.

The continued availability of satellite data is critical to the long term applicability of LACIE-derived technology for operational estimating of global production of wheat and other major crops. This assumes that LACIE proves successful and cost effective. LANDSAT 2 is performing well, with an expected lifetime through 1977 or 1978, and the follow-on satellite (LANDSAT-C), has been authorized. Continued availability or digital multispectral data beyond the early 1980's is not certain. Since the central concept of LACIE acreage determinations is semi-automatic computer processing of multispectral data used in multitemporal analyses: no other known satellite systems can be 'used.

The weather-yield estimating system, as discussed above, does not depend on quantitative data from satellites. It is believed, however, that instruments proposed for future experimental or operational environmental satellites will provide quantitative data useful for this purpose, Continued research and development is necessary in NASA and NOAA to develop these instruments and the technology to derive meaningful geophysical data. Likewise, additional efforts are needed to develop and improve mathematical models which relate meteorological conditions to crop yields. LACIE focuses on wheat acreage, yield and production. Other NOAA efforts are devoted to modeling yield of corn, soybeans, and other important crops utilizing computer facilities at the University of Missouri *in* Columbia.

Advanced computer technology is especially needed in NOAA's basic meteorological research efforts. Basic understanding and skillful prediction of seasonal weather and climate will be achieved only with the aid of computers of very large capacity and speed. Immense volumes of data must be processed to develop adequate global climate models which incorporate at least the most significant of the many complex feedbacks between ocean and atmosphere. Development of models to simulate possible impact of man's activities on climate and to study the dynamics of trace contaminants in the stratosphere similarly require giant computers. NOAA's Geophysical Fluid Dynamics Laboratory (GFDL) already is using an Advanced Scientific Computer (ASC) to conduct fundamental investigations in the dynamics of atmospheric processes over a wide range of time and space scales. These investigations include studies on many scales of motion and a host of interrelated physical processes.

Of particular interest to agricultural meteorology, GFDL mathematical models have achieved reasonably accurate simulations of typical seasonal distributions of wind, temperature, and precipitation. Testing the ability of these models to predict seasonal weather variations using real atmospheric and oceanic observations has not been done and requires very extensive computer power. Progress

[a] Examination of data during two or more critical biological development states (growth stages) of the crop.

will be relatively slow as governed by the availability of computing power, and complementary resources, unless new aproaches to this difficult problem are found.

In conclusion, I am pleased to have been able to report here on the application of advanced technology to several agricultural weather research and service activities. Further progress in understanding weather for agricultural and other types of weather services require that we continue to use the latest satellite and computer technology states-of-the-art. NOAA intends to continue its innovative efforts in this area.

Chairman HUMPHREY. Thank you very much, Dr. White.

Our next witness is Dr. John DeNoyer.

STATEMENT OF DR. JOHN DeNOYER, DIRECTOR, EROS, U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

Dr. DENOYER. Mr. Chairman and members of the Technology Assessment Board, I am glad to have the opportunity to appearbefore this Board to discuss remote sensing programs in the Department of the Interior that relate to food production.

Even though the Department of Interior is not directly responsible for food production, Interior does have man-y activities in terms of data gathering, information dissemination, and management responsibilities that relate directly to food production.

Some of these management activities include the leasing and use of public lands, leasing and monitoring of petroleum production on Federal lands and the Outer Continental Shelf, operation of systems of reservoirs for the combined purpose of recreation, power generation, and water availability for irrigation and management of wildlife resources. Information gathering and distribution of data include baseline data on water availability and quality, mapping of flood-prone areas and mapping of actual floods, geologic information to assist in the exploration for minerals, such as phosphates, needed for agriculture and preparation and distribution of topographic and land-use maps that are basic tools for planning.

Remote sensing technology has demonstrated capabilities or potential for applications in all of these areas. The Earth Resourses Observation Systems (EROS) program was established in the Department to be a focal point for uses of remote sensing throughout the various bureaus and to work with other agencies in applying and planning for remote sensing capabilities that are needed to carry out the departmental responsibilities.

The paper I have submitted to the Technology Assessment Board discusses, in some detail, the ways in which remote sensing is being used in the Department and points out the relation of these uses to food production. I would like to add that similar discussions could be written with other topics as the central focus. Remote sensing allow us to make observations and to preserve these observations in a quantitative and objective way. These data are then useful for many purposes.

The fact that so many diverse disciplines are using remote sensing data sources as tools is having a significant effect on the development of interdisciplinary natural sciences. The fact that Landsat and the NOAA satellites have worldwide coverage capabilities is also encouraging collaboration between scientists in different countries. The importance of improving these types of interdisciplinary and international communications cannot be underestimated when problems such as world food production are considered.

Much has been accomplished since the launch of Landsat-I in July 1972. The research programs have demonstrated many capabilities. Some of these are already being incorporated into the regular functions of governmental agencies and industry. We have also learned a lot in terms of what we should do next.

An improved data processing system that will serve Landsat is being implemented by NASA at the Goddard Space Flight Center. The Department of the Interior is upgrading its capabilities at the EROS Data Center in Sioux Falls, S. Dak., to accept the improved data formats that NASA will be producing and to provide for data reproduction and distribution to users.

These complementary capabilities have been made possible through cooperation in detailed technical planning between NASA and Interior, close coordination at the management levels, and the support of this Congress. We expect to have these improved data processing systems in operation to handle the data from Landsat-C. The result will be that users will be able to obtain much higher quality data in formats that will be easier to use, and the time between acquisition by the satellite and availability to users will be reduced from the present 6 to 8 weeks to 2 to 3 weeks.

The Department of the interior is also working closely with NASA and other participating agencies to define the technical characteristics of follow-on systems that will be needed in the 1980's. We, like the other user agencies recognize the importance of continuity to programs of this type. If there is a single factor that has discouraged full scale use, it is the lack of assurance of continuity.

The interest in receiving training in the capabilities and methods of using remotely sensed data by scientists and managers has been large and is increasing. A full schedule of workshops, structured training courses, and cooperative demonstration projects is being conducted at the EROS Data Center and at applications assistance facilities that are operated by the EROS program.

The purpose of these training and demonstration projects is to transfer technology to organizations and individuals to accomplish their missions more effectively through the use of remotely sensed data. There are also capabilities to satisfy information needs that may not have been practical or possible in the past but are now relatively easy to accomplish through the use of remote sensing.

Mr. Chairman, satellite technology has opened the windows of space to see ourselves as we are and to direct our scientific search for solutions to food and other resource problems. Remote sensing has given us the capability. to monitor many of our environmental conditions and to measure, significant changes. The realization of the importance of these developments is not apparent to all. I am, however, encouraged that the Technology Assessment Board is familiarizing itself with this program.

Thank you. Mr. Chairman.

Chairman HUMPHREY. Thank you.

[The following paper was requested from EROS by OTA:]

SUMMARY OF THE PAPER--REMOTE SENSING PROGRAMS IN THE DEPARTMENT OF INTERIOR THAT RELATE TO FOOD PRODUCTION

(BY John M. DeNoyer)

The Earth Resources Observations (EROS) Program was established in 1906 as a departmental program under the direction of the Geological Survey. As an integral part of the program, an EROS data center was established at Sioux Falls South Dakota which maintains remote sensing archives, including retrieval facilities, and conducts training programs on the use of remote sensing data.

The objectives of this program are: (1) to develop remote sensing capabilities applicable to solving natural resource problems within the department; (2) to conduct and encourage research in remote sensing methods; and (3) to serve as a focus for technical exchanges with other agencies.

The Department of Interior has primary responsibility for the derivation of information relating to energy from water, fossil fuels, and the related environmental effects of development. Its responsibilities relating to food production include: (1) Management of public lands, (2) Management of surface water, (3) Providing baseline information on water availability, quality, and use, (4) Mapping of flood prone areas and actual floods, (5) Conduct of experimental programs in weather modification, and (6) Searching for critical minerals such as phosphates.

Remote sensing data are being used in experimental programs in each of these areas. Preliminary reports indicate that remote sensing data are useful in developing improved management plans for the public lands. They also have been found to be useful in each of the other areas listed.

Many capabilities of remote sensing have been demonstrated. Others are still in the research stage, More areas of application will be discovered as scientists become more familiar with the data and with analytical techniques for processing these data.

The EROS Program has been cooperating with most of the Latin American countries and with Iceland in the use of LANDSAT and other remote sensing methods. In each country the remote sensing data have been utilized to provide information on land use, agricultural development and related areas.

Experience in the EROS program indicates that one of the major deficiencies at the present time is the delay in obtaining data and analyses after the data have been recorded. It often has been impossible to get the information to the program manager at the time he needed it to make his decision.

More emphasis needs to be placed on physical models to turn data into useful information, and more experience needs to be gained in using this information for real management decisions.

Agencies are concerned about becoming dependent on LANDSAT data until there is assurance of continuity beyond 1980. Also too often the data are not available soon enough to be used in making time-critical decisions; and standard photographic products contain less than the complete data, thus precluding their use in some applications.

These latter deficiencies are technical and can be corrected with improved technology. An important result of this program, often overlooked, is the unifying influence of a global data base with uniform characteristics that services scientists in many disciplines in many countries.

REMOTE SENSING PROGRAMS IN THE DEPARTMENT OF THE INTERIOR THAT RELATE TO FOOD PBODUCTION

(By John M. DeNoyer, Director, Earth Resources Observation Systems (EROS) Program, Geological Survey, U.S. Department of the Interior)

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EXECUTIVE SUMMARY

The Earth Resources Observation Systems (EROS) Program is a departmental program, managed by the Geological Survey for the Department of the Interior. The primary functions are--

to conduct and encourage research in remote sensing technology;

to assist in implementing uses of remote sensing technology to operational programs;

to provide a mechanism for technology transfer; and

to provide for data archiving, retrieval, reproduction and distribution of remotely sensed data and related information.

Some important functions of the Department of the Interior that relate to food production are-

management of public lands;

management of surface water;

to provide baseline information on water availability and quality;

mapping of flood prone areas and mapping of actual floods;

conducting experimental programs in weather modification;

searching for critical minerals such as phosphates;

management of petroleum and natural gas production on Federal lands;

management of wildlife resources;

preparation and distribution of topographic maps; and

compilation and distribution of land use maps and related information.

Remote sensing technology has ***some*** demonstrated or potential applications to all of these functions.

Significant progress has been made in using remote sensing technology or demonstrating its applicability for:

water availability;

weather modification;

irrigated land inventories;

impacts of changing land use on agriculture;

rangeland management;

flood mapping;

indications of climatic change:

exploration for phosphates for" fertilizer production; and

energy resources.

Training in the uses of remote sensing technology for agricultural and other disciplines needs additional attention.

Major problems and deficiencies in the current remote sensing program are-

lack of assurance of data continuity;

data are not available soon enough for management decisions or environmental and emergency applications;

standard photographic products should be of higher quality;

inadequate physical models to use the remotely sensed data; and

inadequate management models to use information derived from remotely sensed data.

Global remote sensing has-

improved interdisciplinary scientific communication;

improved international scientific communication; and

made new types of global scientific studies possible.

INTRODUCTION

The Earth Resources Observation Systems (EROS) Program was established in 1968 as a departmental program to: (1) develop remote sensing capabilities applicable to solving natural resource problems within the department, (2) conduct and encourage research in remote sensing methods, (3) work with the various bureaus of the department in implementing uses of remote sensing technology into operational programs, and (4) serve as a focus for interagency technical and programmatic exchange with other agencies, In addition to these functions, the EROS Data Center is a major facility for remote sensing data archiving, retrieval, reproduction and distribution that is operated at Sioux Falls, South Dakota. Emphasis is also placed on technology transfer of uses of remotely sensed data through applications assistance, technique development appropriate for operational uses, demonstration projects and training programs, In the intensive agricultural practices of the United States, the availability of energy and the production of food are inexorably linked. The Department of the Interior has a prime responsibility for the derivation of information relating to energy from water, fossil fuels, and the related environmental effects of development. In addition, the department has other responsibilities that relate to food production that include:

Management of public lands.—The Bureau of Land Management is responsible for realty activities on all national resources lands, the Outer Continental Shelf, and large areas of Federal land under other agency surface management (e.g., national forests.)

This area comprises more than 182 million hectares (450 million acres) still in Federal ownership, as well as the publicly owned mineral resources on about 25 million hectares (61 million acres) of privately owned lands, and the Outer " Continental Shelf.

Management of surface water.—The Bureau of Reclamation and the Bonneville Power Administration are directly responsible for management of major quantities of water that is used for irrigation of agricultural lands in the western ~ United States.

Providing baseline information on water availability, quality, and use.— The Geological Survey is the primary agency for collection of water data and for compiling ground water and surface water data collected by other agencies. The rapid growth in the use of ground water for irrigation emphasizes the importance of this activity.

Mapping of flood prone areas and mapping of actual floods.--- *The* Geological Survey conducts many of these flood mapping activities. Such maps have direct applications to agricultural planning and damage assessment to crops.

Conduct experimental proqrams in weather modification.-- The Bureau of Reclamation is conducting experimental programs in weather modification to increase water availability and for hail suppression. Both of these objectives have a direct bearing on water availability for irrigation and minimizing crop damage.

Searching for critical minerals such as phosphates.— The use of phosphates to improve agricultural production is increasing. The location of phosphate deposits requires basic geologic information of the type that the Geological Survey prepares.

Management of petroleum and natural gas production on Federal lands..- Petroleum and natural gas have become very important for preparation of fertilizers, operation of farm equipment, processing of agricultural products and transportation of farm products. The Bureau of Land Management has responsibility for leasing of potential petroleum producing areas on Federal lands, and the Geological Survey is responsible for technical consultation with the Bureau of Land Management prior to leasing and supervision of the leases through the development and production phases. Geologic mapping on land and marine geologic investigations conducted by the Geological Survey serve as the basis for most of the more detailed exploration programs conducted by the petroleum industry.

Management of wildlife resources. —The Fish and Wildlife Service is responsible for the conservation of many types of wildlife and their habitats. The natural resources of wildlife contribute directly to food supplies and are also important for the balance of nature that is essential for future food availability.

Preparation and distribution of topographic maps of the United States.— These maps are prepared by the Geological Survey and form the basis for most planning and engineering development in the country.

Complicatiom and distribution of land use maps and information-- The Geological Survey is conducting a hind use mapping program that will be completed for the conterminous states within a few years. Times data will be essential to the quantitative evaluation of relationships between land use for agriculture and other competing uses.

Remote sensing can contribute to information gathering and analysis, in terms of efficiency, timeliness and accuracy for all of these activities. In some cases, remote sensing is the only way to collect the necessary data and perform an analysis in a timely manner.

REMOTE SENSING APPLICATIONS

A number of specific research projects, demonstration projects and cooperative programs are in progress within the EROS Program at the present time. Others have progressed to the point that the participating organizations are continuing the work initiated by the EROS Program. These activities are all conducted with the direct participation of the responsible agencies. The participating agencies include Federal, state, local, and foreign governments, and domestic and foreign organizations. The following discussion will be restricted to uses of remote sensing technology and related uses of data collection platforms.

Water Availability

The efficient and practical use of water is the key to successful agricultural production, both of plant crops and meat products. The use of remote sensing technology, including the use of images from the Landsat Earth orbital satellites, is proving to be an aid in the agricultural field in three ways: (1) in determining the volume and availability of water for agriculture, (2) in aiding in the distribution and management of the agricultural water supply, and (3) in assisting in the determination of the quality of water for agricultural purposes.

In many areas of the United States, ground water is "mined" (extracted at a greater rate than replenished), and information relating to the rates of extraction, the means of replenishment, and the availability of temporary sources of water, such as playa (temporary) lakes, is currently limited. Promptly delivered and analyzed satellite images can assist in the inventory af available water and determining and protecting the most effective points of aquifer recharge.

The volume and availability of water is determined in different ways for different purposes. Mapping of the extent of surface water in lakes, rivers, and other inland water bodies and in the measurement of the changes in the amount of water in storage is readily facilitated by periodic analysis of Landsat images. Recent work by the U.S. Army Corps of Engineers and the National Aeronautics and Space Administration has shown that water bodies as small as 1.6 hectares (4 acres) can be identified and mapped, and changes in area covered by surface water can be readily discerned over periods of time.

Because irrigated agriculture is primarily supplied from surface water sources, the assessment of the distribution of such water is of vital importance in determining the areas that can be irrigated during a given year, assessing the amount of water available at the beginning of an irrigation season, and in determining the source areas for water which may not now be used for irrigation but which could possibly be used in the future.

Much of the water available for irrigation and other uses in the western United States occurs as snow and is released when the snow is melted during the spring and early summer. Monitoring of the mountain snow pack during the winter and the melting of that snow during the spring thaw period can aid in the forecasting of water supplies and in determining their allocation during the irrigation season. The U.S. Geological Survey participates in the monitoring of the mountain snow packs. At present a cooperative project between the USGS, NASA, and other agencies is being undertaken to demonstrate the feasibility of using such snow cover mapping and water runoff forecasting in California, Colorado, Oregon, and Arizona.

Use of ground water for irrigation is on the increase in the western United "States. Exploration for ground water is aided by the analysis of Landsat images to locate aquifers, or water bearing formations, that occur just below the surface of the land. Such aquifers may be indicated by the pattern of the rocks and sediments, the vegetative indicators, and by land-use clues, While much of the exploration for ground water must inevitably rely on drilling and definite proof of the availability of adequate supplies of water, initial indications of the presence of ground-water bearing formations may be obtained from the analysis of Landsat images and may guide efficient programs of exploration and drilling.

The distribution and management of water systems for irrigated agriculture requires real time decisions, on the present and continual availability of water, and the means which will distribute water to the users at the appropriate time. Remote sensing technology allows the water manager access to an up-to-date inventory of the amount and distribution to irrigated lands as well as availability of water for irrigation. Measurement of amounts of wateflow in rivers, canals and distribution systems is monitored by telemetering the data into the water manager's office.

Water data is used in two prime ways. The first is in exploration for water. Knowledge of the amount of water available at a given time and its quality is an essential factor in planning for the construction for large water distribution and diversion works and for the decisions on the allocation of financial and other resources for the production and management of such water. Landsat image analysis can significantly aid in determining such characteristics of the water and the terrain and can aid in the scientific and engineering planning for the development and in exploration of water resources.

The second, management and regulation of water resources, requires real time knowledge on the availability of water at various points and time and at various places. The continuing repetitive nature of Landsat images allows an assessment by the water manager of availability of water and the ability to have information on the availability and flow of water at various points telemetered directly to his office allowing him to make faster and more efficient decisions on the allocation of that resource.

The applications of remote sensing to the study of water resources have been summarized in a recent report of the Space Applications Boardd of the Academy of Engineering of the National Research Council. It provides detailed assessments of the types of data needed for management of inland water resources, of the benefits that may accrue from better management of inland water resources based on the use of remotely sensed data, and suggests several demonstration projects that could be undertaken to provide such proof. The Geolgical Survey has engaged in research on the applications of remote sensing technology to water resources problems for a number of years and has actively been involved in a number of water management groups within the United States in such projects. The benefits to be achieved from these applications are potentially large. Achieving the desired objectives and maximum benefits will require the continued involvement of management groups and a continuation of the research leading to the demonstration of feasibility of the specific application.

Weather Modification To Enhance Water Availability

Seven Landsat data collection platforms (DCP's) have been used by the Bureau of Reclamation in a major winter weather modification program designed to determine the feasibility of enhancing runoff into the Colorado River Basin. The platforms, located in the severe winter environment of the San Juan Mountains of southwestern Colorado, have been operated snee the spring of 1973. Temperature, precipitation, solar radiation, streamflow, humidity, and snowpack water equivalent observations are routinely relayed by Landsat to the Goddard Space Flight Center where they are transmitted to a Denver computer and are available via teletype terminals within 3 to 8 hours from on-site transmission.

During the 1973-1974 winter season, the platform system proved to be a valuable tool in providing additional and mare rapidly acquired data for weather forecasting, cloud *seeding* operations, streamflow forecasting, and evaluation purposes. Data have been used for near real-time monitoring of meteorological and hydrological data for control of cloud seeding operations and verification of weather forecasts. Project experience has shown the Landsat field installations to be remarkably reliable, weather resistant and cost effective with the capability of relaying high-quality data in near real time. The availability of such data contributes *to* the decision making processes of the Bureau of Reclamation's research and development program in precipitation management.

Another study was initiated during the summer of 1975 near Miles City, Montana. This study involves testing the effectiveness of recording rainfall in the High Plains through use of Landsat. The satellite relays data from 64 rain gages and provides reliable, nearly instantaneous rainfall information. The project is part of the Bureau of Reclamation's High Plains Cooperative Program, a comprehensive research effort to refine the technology for seeding summer clouds to increase rainfall over the High Plains States.

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An automatic system for the collection of precipitation and other meteorlogical parameters from the Miles City cloud seeding site has been developed and tested. The design incorporates a network of digital precipitation gages operating within a 10-kilometre (12-mile) radius of a Landsat. DCP. The design also includes a concept for data collection by aircraft from a network of gages operating over an area of several thousand square miles. Two Landsat/Geostationary Operational Environmental Satellite (GOES) compatible DCP's will also be installed in the project area. A variety of meteorological data parameters including average wind speed and direction, temperature, and humidity will be relayed for project control and to evaluate the effect of cloud seeding research.

The *use* of satellite imagery from GOES is also being considered within the Bureau of Reclamation's Atmospheric Water Resources Management Program. The availability of near real-time imagery will provide valuable information on cloud growth and location for project management. The pictorial record of cloud events will also be of value for evaluating the results of cloud seeding.

The Bureau of Reclamation is currently providing technical support and laboratory facilities to the Soil Conservation Service (SCS) of the Department of

Agriculture for examination of the Upper Rio Grande drainage in the Sangre de Cristo-San Luis Valley area of Colorado. SCS is developing runoff forecasts based on snowpack information derived from satellite imagery.

Irrigated Land Inventoried

Inventories of irrigated lands are important for estimating agricultural pro duction. They are also important in planning of water management. Water management involves both surface water and ground water. Surface water management must include recreation, wildlife habitat, flood control and power generation as well as irrigation requirements, The use of ground water for irrigation is increasing rapidly in a number of western states. Continued increases in and widespread use of this resource must consider the impact on the water table and on the ability of the aquifer to recharge at a rate comparable to rate of water withdrawal.

Center-pivot irrigation systems we readily observed on Landsat imagery, particularly band ***5 (600-700*** nanometres), the red band, and in false-color composite images where contrast between irrigated and nonirrigated areas is marked. In recent years deployment of center pivots has increased rapidly; Nebraska, for example, is currently adding about 2,000 per year. In some areas, the increased deployment could affect the local ground water table. Both the University of Nebraska and the EROS Program have used Landsat imagery to count the num- number of center pivots for the entire state during the irrigation seasons of 1972, 1973, and 1$74. Analysis of such imagery shows that the number of center pivots in part of Holt County, Nebraska, increased from 508 in July 1972, to 552 in July 1973, and to 740 in August 1974.

An inventory of irrigated agricultural lands is being conducted in the Klamath River basin of Oregon in cooperation with the Oregon Department of Water Resources. This project is designed to demonstrate the utility of multidate Landsat data and manual analysis techniques for inventorying and monitoring irrigated land area. The Klamath River Basin Compact between the States of ***Oregon*** and California limits the acreage of land in each state that may be irrigated within the basin. Compliance with the terms of this compact requires annual inventories of the irrigated acreage so that regulation can be imposed as the limit is approached. The EROS Program, through the Pacific Northwest Regional Commis- mission Project, is assisting in a demonstration of the use of 1:250,000 Landsat color composite prints acquired at two or three dates during the growing season, together with manual delineation of irrigated land and dot grid sampling procedures to estimate the acreage of irrigated land.

In the Bureau of Reclamation, satellites such as Landsat are revolutionizing data collection, and the application of remote sensing technology promises to become increasingly useful as the full range of its potential is explored and exploited. Consideration is being given to the future use of remote sensing to assist in obtaining information for the following types of Bureau activities:

(a) Periodic inventory of irrigated lands and cropping patterns to determine changes in area for improved water use projections; and land use inventories to identify environmental problems and growth patterns.

(b) Gathering of crop census data on projects more accurately and economically. The potential also exists for determining the state of plant vigor and associated yield estimates.

(c) Timely **and** rapid acquisition of basic water resources data to achieve better conservation. management, and use of existing supplies. A typical example would be the periodic monitoring of water surface areas at remote reservoir sites to assist in measurements of water lost to evaporation.

Impacts of Changing Land Use on Agriculture

The availability of Landsat imagery since July of 1972 has provided scientists, planners, environmentalists, cartographers, geographers, economists, and others with the data and the means to objectively monitor environmental impact caused by man's activities and the attendant changes in land surface cover. Not only is such monitoring of environmental impact and changes in land surface cover possible for the United States but for all the land areas of the world as well.

In the United States the land classified as agricultural is one of the most variable because it is subject to seasonal change, change in crop type, or conversion to industrial or residential land. The current Landsat technology, for instance, could provide each state and the nation as a whole with an annual inventory of total land under cultivation on a seasonal basis. This information could then serve as the basis for estimating the amount and distribution of agricultural land being converted to non-agricultural use.

The EROS Program is participating in a demonstration project to measure the conversion of cropland to urban land. Four specific areas are included in this project. The areas are: (1) the 10 largest urban areas in the State of South Dakota, (2) the Atlanta, Georgia, urban area, (3) the Puget Sound urbanized area, and (4) the Portland-Willamette Valley urban area. In each of these areas, the analysis is being conducted in cooperation with Federal, regional, state and/ or local agencies to demonstrate the applicability of satellite and aircraft data to urban land use planning. One of the principal concerns of land use planners is determining "highest and best use" of a given parcel of land. It follows that, as property values rise in urban or near-urban areas, the competition between conflicting land uses becomes of major interest to land use planners. Thus, timely, economical and reliable estimates of the rate of conversion of prime, high-value, agricultural land to urban uses, is a primary information requirement. Within each of the study areas, the utility of multitemporal Landsat data and interactive digital image analysis techniques for meeting this information requirement is being demonstrated.

Rangeland Management

The purpose of rangeland management as conducted by private enterprise or by Federal or state governments is to ensure the highest production of cattle and sheep commensurate with conservation and maintenance of good condition of' the rangelands. This is an example of the sustained yield concept or the maximization of production over a long period of years rather than maximization for only a short term with consequent degradation of the range conditions which could lessen production in later years. The rangeland manager has two basic tasks that can be facilitated by remote sensing technology and particularly by the use of Landsat images. The first is basic assessment of rangeland condition and determination of the grazing capacity of the range. The second is monitoring of the range conditions for day-to-day and year-to-year management.

Basic assessment of the range involves mapping and describing grazing lands so that the soils and water conditions are well known and the type, distribution, and density of vegetation is well known. From that, the capacity or number of grazing animals per unit area can be determined. Research, using Landsat images, in both the United States and Australia is demonstrating that the land can be subdivided into areas of varying grazing capacity based on the vegetation, soils, and nature of the land surface. The Landsat images are satisfactory for such an evaluation at small scale over large areas.

Monitoring of range conditions will provide the range manager with information to determine what the grazing capacity of the range should be for a given year, whether it is wet or dry, whether there has been natural or manmade degradation of the land, and whether or not rangelands have been improved by management practices. Degradation of rangelands can take place by overgrazing or erosion. These features can be seen on Landsat images and can be quantified by digital processing of the images.

It is necessary for the rangeland manager of public lands to set the grazing capacity of these lands in any given year in such a manner that the land will not be required to carry too many grazing animals, and thus be degraded, and yet not carry too few grazing animals so that production may be optimized. The qualities of the Landsat images are such that these decisions can be made. The major deficiency at the present time is in obtaining data and analyses rapidly enough to get that information to the manager at the time that he needs to make his decision.

The Bureau of Land Management and EROS have sponsored a pilot study in rangeland monitoring in the Susanville district of California. The study, conducted by the University of California, Berkeley, was directed at a large variety of problems that are of concern to the bureau, and the results are to be made widely available within the bureau, so that applicable portions can be utilized operationally in the various regions. Specific demonstrations from this study include the ability to make rapid regional assessments of range class conditions to guide release or withdrawal of grazing leases. The capability to monitor change in water areas of large stock ponds and range reservoirs can be used to guide decisions concerning grazing leases. Rapid changes in range conditions can occur as a result of floods, hail, wind, temperature, drought, and disease. The effect of all of these factors on range conditions can be monitored by use of Landsat data, but rapid processing and analysis of the derived information is necessary in order to make timely management decisions.

This study determined and demonstrated the feasibility of utilizing Landsat data to monitor the seasonal change of range conditions within the annual grassland type of California. The seasonal condition of the forage Is directly related to the quality and quantity of available forage. Monitoring these changes provides inputs for determining the relative amount of forage produced, the location of high-quality forage, the timing of livestock movement to and from rangelands, and the fire hazard associated with dry forage.

This study and related investigations have been important considerations by the Bureau of Land Management in the preparation of a comprehensive, strategic long-range plan. This plan will adapt the latest in automatic data processing and remote sensing technologies into a Bureau of Land Management information system. The strategic plan is designed to point the direction in which the Bureau of Land Management might go in these areas and to provide a basis for *more* informed decisions about (1) the acquisition of information system hardware and software, (2) the automation of system data, and (3) the use of remote sensing technology.

The integrated approach to using automatic data processing and remote sensing technology will include the following areas: domestic livestock grazing, fish and wildlife ecology and habitat development, outdoor recreation, timber production, watershed protection, wilderness preservation, minerals development, environmental protection and enhancement, river basin planning, and general land use classification under the concept of multiple use. Resource management and development activities are supported by a construction and maintenance program which provides and maintains roads, trails, and physical improvements such as recreation facilities and watershed control structures; and by an active program to protect the public lands and their resources from wildfires and from all other forms of public and private misuse.

The EROS program has been cooperating with most of the Latin American countries in the use of Landsat and other remote sensing methods. Many South American countries realize that Landsat data can provide them with much of the information that is needed for natural resource inventory, planning, and development. Bolivia, for example, has vigorously pursued a multidisciplinary approach in which geologists, hydrologists, agronomists, and foresters worked together to produce maps *in* their respective disciplines and then combine these into what are called "land capability maps." These maps show where farming, grazing, irrigation, and other types of development are feasible. State planning organizations have seen the value of these initial maps and have urgently requested that other areas be done as soon as possible.

Repetitive observations from satellite images have shown that some of the savannah areas of southeastern Bolivia, being planned for colonization and agricultural development, are periodically inundated by floods and, as a result, safer areas have been chosen.

In southeastern Colombia Landsat images have shown the extent of slash and burn development for cattle grazing in the tropical jungle near San Jose de Guaviare in the western headwaters of the Orinoco River basin. Repetitive images from Landsat will enable monitoring of the growth and changes in range conditions.

New colonization on the Caribbean side of the volcanic mountain range of Costa Rica has been partially mapped from Landsat images. Cloud cover has hampered completion of conventional aerial cadastral surveys. Development has gone on in this area for more than 15 years but has never been adequately recorded. Consequently, the Costa Rican government has been unable to determine the extent of this growth, nor estimate its impact on its national economy.

The U.S. Geological Survey participated in a cooperative program *between* NASA and Brazil for uses of remote sensing that was initiated in 1968. Brazil now has its own technical expertise and is able to conduct its own remote sensing programs. A specific example is the use of airborne side-looking radar (SLAR) under Project Radam that has completed the mapping over 4.6 million km^2 (1.7 million square miles) of the Amazon Basin. Analyses of the SLAR mosaics have resulted in geologic, hydrologic, forest and soils maps that have demonstrated the vast resources that are available for development. Brazil is now in a better position to plan orderly development of mineral resources, communities, forest and farming regions, highways and power sources of the vast Amazon Basin. Satellite images are now available to monitor such growth. The Government of Brazil has recently extended SLAR coverage to the entire nation. Neighboring countries. such as Colombia, Venezuela, Ecuador, and Peru, all aware of the Brazilian experience, have adopted the method for other parts of the Amazon and Orinoco Basins.

In Iceland, animal husbandry, particularly sheep and cattle, is an important element of the economy. Grass, therefore, is an important agricultural resource.

Although Iceland was forested at the time of initial settlement in 874 A.D., the excessive harvesting of timber, the irrtroduction of large, free ranging flocks of sheep, and the apparent slight deterioration of the climate have resulted in almost total denudation of forested land. Birch, dwarf birch, and willow trees and various bushes exist in favorable locations, but only two sizeable areas of true forest still exist, Hallormsstadur in eastern Iceland, and Vaglaskogur near Akureyri. A cooperative investigation between U.S. and Icelandic scientists has used Landsat false-color composites to demonstrate that accurate inventories of areas covered by trees and bushes can be made that will assist in planning future reforestation work. Of greater importance, however, will be the ability to provide accurate inventoried of grasslands with such imagery. A preliminary study of MSS false-color composites of various parts of Iceland has shown that at least five' vegetation types can be mapped on Landsat imagery. These are: (1) bushes, dwarf trees, and shrubs; (2) natural grasslands; (3) reclaimed land; (4) cultivated homefields; and (5) lichen-covered lava fields. In addition, barren lands can be delineated by their absence of vegetation.

The agricultural industry of Iceland is heavily dependent on the areal extent, health, and growth rate of the grasslands. The grasslands are usually divided into lowlands and highlands. The highlands are used for grazing by sheep during the summer months. The lowlands are used for cattle and Icelandic ponies during the late spring, summer and early fall.

The highland grasslands are used in their natural state, while some of the lowland grasslands have been subjected to extensive ditching to lower the water table, thus improving the soil properties and increasing the grass yield. On the homeflelds, the application of fertilizer, ditching, and seeding have markedly increased the yield. The harvesting of hay from the homefields provides the feed for the animals kept through the winter months.

Considerable effort is being expended to reclaim the overgrazed lands through reseeding and fertilizing of barren areas. Many areas are also being reforested to reverse the post-settlement trend of soil erosion. The reclamation program is directed at an increase in the area of grazing lands to meet the future resource needs of a rapidly growing Icelandic population. In 1974, on the occasion of the 1100th anniversary of the settlement of Iceland, the Icelandic Parliament passed a bill to restore the land to its pre-settlement condition. a costly project which will encompass decades of effort Landsat imagery could provide an effective way of monitoring the progress of this land reclamation project, if acquisition of coverage over Iceland can be assured.

Flood Mapping

A collaborative study of 1920 river kilometres (1200 river miles of the Mississippi flood that occurred during the spring of 1973 was conducted by the U.S. Geological Survey, NOAA, NASA and the U.S. Army Corps of Engineers, Several investigators developed methods during this study to apply optical and digital data processing to delineation of the flooded area. The results of these investigations demonstrated important engineering, economic, disaster relief, and planning applications. Landsat data obtained before, during, and after the flood were essential in conducting these studies.

As a follow on to these earlier research efforts in flood mapping, Landsat-2 imagery was ***used*** by the State of Louisiana and the Geological Survey to map the extent of flooding of the lower Mississippi River, and the Red, Ouachita, Black, and Atchafalaya Rivers during mid and late April 1975. Through special arrangement with NASA, Landsat imagery was received from Goddard Space Flight Center 2 days after the satellite had made its orbital pass. Analysis of the imagery was performed jointly by personnel of the Louisiana Office of State Planning; the EROS Program Applications Assistance Facility at Bay St. Louis, Mississippi, and the Geological Survey Geography Program. By comparing unpublished Land Use Data and Analysis (LUDA) maps with flood-time Landsat imagery, State officials delineated flooded areas and determined that flood waters covered approximately 3,200 hectares (8,000 acres) of urban and other highly developed regions, 120,000 hectares (300,000 acres) of farmland, 43,600 hectares (109,000 acres) of upland forest, 279,200 hectares (698.000 acres) of wetland forest, and 1,120 hectares (2,800 acres) of sand land silt areas. These totals were then broken down in ‘accordance with areas in each parish (county) that had been flooded. Both the maps and statistics were used by the State for rapid analysis of flood damage and to document immediately the need for allocation of Federal disaster relief funds. According to the Louisiana State Planning Office, the results of the study indicate that Landsat data provide a fast, accurate, and a relatively inexpensive method of compiling flood data for disaster planning and post-flood analysis.

In July, 1975, flooding occurred in the Red River Valley of Minnesota and North Dakota. The EROS Program, in continuation of its on-going activities in developing remote-sensing technology for flood applications, conducted an investigation on the flood, which had a profound impact on the rich agricultural lands of this area.

The Red River flood posed a particularly difficult challenge in that the soils of the Red River Valley tend to be very dark and hence provide low contrast with wet soils and standing water, which also are poor reflectors of incident solar infrared radiation. Previous experimentation had demonstrated the capability of Landsat multispectral scanner data to detect, delineate, and classify not only the flooded from the non-flooded areas, but to distinguish types of flooding and various characteristics of the flood plain. Employing digital analysis techniques, Survey scientists used Landsat data of the Red River flood and successfully separated areas of overbank flooding from flooded agricultural fields resulting from impeded precipitation runoff. The processing techniques employed made it possible to increase the contrast between the low reflecting soils in areas affected by flooding and those not affected by flooding, and between areas of standing water and saturated soils. Analysis of the post-flood data revealed the extent of crop loss and damage.

Utilization of Landsat data and optical and digital processing techniques specifically developed for flood assessments makes it possible to automatically depict the exceedingly complex distribution of the flood waters in a matter of hours, whereas traditional procedures require many man months of effort employing manual photointerpretation and depiction of boundaries. Accuracy of mapping of overbank flooding based on Landsat data has compared favorably with results obtained by traditional techniques. It is unlikely that the complex distribution of flooded agricultural fields of North Dakota that were depicted automatically by digital analysis could have been accurately mapped by traditional practices employing black and white panchromatic aerial photography.

A serious constraint in the usefulness of flood assessments by any technique is the timeliness of data availability and analysis. Under the current experimental Landsat Program, film imagery or computer compatible tapes are not received routinely by investigators in the field until six weeks or more following imaging of the study area by the satellite. In terms of flood assessments, historical data obviously is of little or no value for guiding rescue operations, identifying disaster areas for governmental or insurance applications, or for monitoring the progress of the flood wave down the valley.

Flooding in the Susquehanna River Valley occurred following Hurricane Eloise in 1975. A request was made to the Canada Centre for Remote Sensing to employ their Prince Albert satellite data reception facility to collect the data transmitted by Landsat-2 on its first post-flood orbits over the Susquehanna River basin. Two scenes covering the flooded area between Williamsport and Harrisburg were imaged by Landsat-2, transmitted to Prince Albert, recorded on magnetic tape. converted to film and shipped to the United States within 24 hours of data acquisition. Two additional days were required for shipping and release from U.S. Customs. The data were in the hands of investigators within 72 hours from acquisition by the satellite. The extent of flooding and the areal extent of the surface water at the time of imaging and general surface conditions are clearly depicted on the processed imagery.

Indicators of Climatic Change

It is impossible to work in analysis programs using satellite remote sensing data without realizing that many of the parameters being measured could be of importance to understanding climatic change. The direct effects of climate on agriculture and food production are observed throughout the world.

As the world population increases and greater demands are made on the major areas of croplands, climatic fluctuations or trends will take on more and more significance. The recent drouth in the Sahelian region of Africa has caused the disruption of entire societies. Reduced crop yields in the U.S.S.R. have forced the Soviet Union to make large grain purchases on the world market. At higher latitudes, the reduction in length of the growing season impacts on the magnitude of crop yields and even what crops can be grown,

In the 1960's sea ice moved into the coastal areas of Iceland and the average annual temperature was lowered. This had a devastating effect on hay production in the northern and to a lesser extent in the southern part of Iceland.

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Parameters, such as the extent of snow fields, retreat and advance of ice caps, behavior of glaciers, characters of the "green wave" of vegetation as it moves to higher latitudes in the spring and the "brown wave" as the vegetation dies or becomes dormant in the fall, and surface temperature characteristics of large bodies of water including the oceans, can be measured directly by remote sensing. Global surveys are needed for climatological research. Satellites provide many of these capabilities.

Documentation of parameters that are significant to climatic change should become a standard practice of all scientists who are working with remotely sensed data. These analyses can then be used by appropriate organizations in establishing climatic trends and hopefully as a basis for climatic prediction in the future.

Phosphate for Fertilizer

Sedimentary phosphate rock is an increasingly important raw material for production of agricultural fertilizer, A common problem in prospecting for this material, however, is that cursory field observation reveals few physical properties which distinguish phosphatic from non-phosphatic beds. Although small hand-carried ultraviolet lamps have been used to stimulate luminescing minerals and rocks, including phosphate rock, these methods of prospecting are limited because the lamps are low powered, effective range is limited to a metre or less, and the work must be conducted at night because the low intensity luminescence is obscured by bright sunlight.

The Fraunhofer line discriminator (FLD) is an airborne optical mechanical device which permits daylight detection of luminescence several orders of magnitude below the intensity detectable with the human eye. This instrument was developed through cooperative programs between NASA and the U.S. Geological Survey., Helicopter tests during 1974 and 1975 have shown that FLD response to gypsiferous and phosphatic beds of Miocene age northeast of Santa Barbara, California, exceeds nonphosphatic beds 'by a factor of two. Laboratory measurements of eight phosphate rock samples from the United States, Brazil, and Colombia show that all appear to luminesce within the sensitivity limits of the FLD.

Liquid effiuents from processing of phosphate rock commonly contain materials which can contaminate surface and ground water and be injurious to vegetation. Laboratory analysis of samples collected from central Florida show that these effuents are luminescent, exceeding the luminescence of background streams by more than a factor of five. These results are confirmed by airborne FLD measurement of the luminescence of effluents from several central Florida processing plants which was performed in early 1975 in collaboration with the Environmental Protection Agency.

***Energy* Resources**

Central to the production of agricultural products is the availability of energy for field preparation, irrigation, harvesting, drying, transport, and refrigeration; this, in addition to the derivation of fertilizers from petrochemicals, focuses the Department of Interior's energies on the use of new techniques for the inventorying and finding of new sources of energy.

Space observations are becoming increasingly important in this search and in understanding the environmental impacts of energy development. These observations add to our current capabilities of discovery and environmental assessment by providing an overview that can add to our efficiency in exploration.

In terms of discovery and production, satellites now in orbit can help us in at least six ways. These are:

1. Detection of geologic structures that were previously unknown and may be significant with respect to the localization of hydrocarbons;
2. The possible detection of very subtle tonal anomalies, that may represent alteration of the soils resulting from mini-seeps of gas from hydrocarbon reservoirs;
3. The potential for detecting natural marine oil seeps with consequent improvement in efficiency of offshore exploration;
4. The monitoring of ice distributions and movement in Arctic areas, such as may affect transport of materials in and out of the Arctic; the cost of seismic exploration in Arctic sea ice areas, and the safety of exploration and production operations;
5. The monitoring of oil field development and transport facilities, such as the Alaska pipeline and an assessment of this development upon the environment;

6. The images are useful as base maps in poorly mapped parts of the world.

Landsat data is being used by international oil firms for exploration in poorly mapped regions in the headwaiters of the Amazon Basin. Bolivia has used Landsat data to plan a gasline from Sucre to Puerto Suarez, which will eventually connect with major industrial markets in Sao Paulo, Brazil.

Studies conducted by Chevron Overseas Petroleum, Inc., have demonstrated how Landsat data have assisted in petroleum exploration in Kenya. The imagery permitted company scientists to outline the boundaries of the sedimentary basin that is of interest. This led to more intelligent locations of boundaries to the concession that was negotiated with the Government of Kenya. Information on geologic structures in the basin, obtained from interpretation of the Landsat images *is* being used as a guide for planning and carrying out the detailed geological and geophysical field investigations.

In Alaska, landform analysis of Landsat images, substantiated by geophysical data, led Geological Survey scientists to propose a new area for petroleum exploration. The images show that lakes in the Arctic Coastal Plain are dominantly elongated with the long axes parallel and trending about N 9“ W. Northwest of the Umiat oil field, an additional strong east-trending regional lineation, not previously recognized on aerial photographs or in field studies, is expressed by elongation of some lakes, alinement of others, and by linear interlake areas. The trend of this lineation is parallel to the trend of deflections in contours of the magnetic and gravity fields in the area and parallel to westerly deflections in the northwest ends of northwest-trending folds mapped to the south. In addition, the alinement of many small lakes forms a large ellipse superimposed on the regional lineation. Sparse seismic profiles show periodic reversals in dip and regional arching in shallow strata beneath the area. Collectively, these data suggest that heretofore unsuspected deep structures may be concealed beneath the younger Quaternary Gubik Formation that covers the area of the image. In addition, strata *in* shallow folds are younger than those tapped by the oil wells of the Umiat field to the south, and may contain favorable reservoir beds.

Mosaics of the conterminous United States, compiled by the Soil Conservation Service for NASA, have been analyzed by U.S. Geological Survey geologists interested in linear features that may be of tectonic significance. Mosaics at scales of 1 :5,000,000 and 1 :1,000,000 were used to evaluate and identify new and to reevaluate previously known geologic features. Studies of smaller regions have shown that the occurrence of major mineral deposits is closely related to the intersection of linear features that are major fracture systems. Similar studies of gas-producing areas in the Appalachians show that the most productive gas wells are near or within areas of highly fractured bedrock.

Recent petroleum discoveries in the Mobile Bay region of Alabama prompted Halbouty Oil Company to conduct an independent experiment to determine whether or not *use* of Landsat data can provide insight into possible ***extensions*** of petroleum producing areas in a region of active exploration, if these data can aid in re-evaluation of existing subsurface information, and the importance of these interpretations for planning subsequent seismic and other geophysical surveys.

Landsat images of the area were interpreted for linear and curvilinear features. These were compared with a map published by the Geological Survey of Alabama depicting the general trends of exploration potential extending from Mississippi into the State of Alabama. The location of producing fields was superimposed on this information. Significant results of this investigation are:

Landsat interpretations reveal some associations where producing fields are alined along linear features or are on the flanks of large curvilinear features.

Several major discrepancies between the subsurface maps and features interpreted from Landsat data were noted. For example, the Citronella field, one of the largest fields producing by artificial lift from depths greater than 10,000 feet is shown on the crest of a dome at depth while the Landsat imagery suggests that it is in an interdomal area. Also the structural interpretation of the Mobile graben differs significantly from the interpretation derived from subsurface data. Landsat interpretations suggest that the structure is much more complex in the northeastern quadrant of the area than is reflected by the subsurface contours.

Landsat imagery shows promise as a tool to monitor energy-related development in Alaska. Examination of the vegetative cover, on a false-color composite Landsat image of the Umiat oilfield, revealed only one indication of scarring of the delicate tundra as a result of the intense oil exploration in this area in the late 1940's and early 1950's. This suggested that the environmental effects of oil exploration were not spreading but rather were healing. This conclusion was largely substantiated by low-level helicopter surveys undertaken by Geological Survey scientists in the summer of 1973. One short, clear-dozed, and repeatedly used trail near Umiat still formed a marked scar.

In response to the increase in coal mining activity in the Appalachians, the U.S. Geological Survey, in cooperation with other Federal and state agencies, is assessing the effect of coal mining on water quality, sedimentation, and streamflow of eastern Tennessee. Aerial thermal infrared imagery is used to delineate ground water outflow, pending on strip mining benches, storm runoff, surface water flow, and indications of acid mine drainage. Digitally processed Landsat imagery is used to delineate land cover categories including forest, groups, agricultural land, and bare earth caused by strip mining. The Landsat analyses are useful for updating geologic maps showing strip mining activity, and for direct comparison with the status of strip mining in the late 1960's when the field mapping was done. An analysis has been completed for the dates of February 19, 1973, March 23, 1974, October 10, 1974, and March 26, 1975, for the Duncan Flats Quadrangle at a scale of 1:24,000. The resulting maps show both active and inactive strip mines, the extensions of bare earth areas, regrowth of' vegetation and the effects of strip mining on sedimentation in streams.

The Canadian Centre for Remote Sensing has recently completed a study showing the importance of meteorological satellite and Landsat data to sea ice monitoring in the Canadian Arctic. The study projects large benefits for inbound and outbound shipping in this area. It also considers reduction in damage to ships by identifying navigation hazards in ice-infested waters, increased productivity for marine seismic crews, and the types of data needed for operational decisions to continue drilling or to cease drilling for petroleum in this region. The benefits for the Canadian Arctic are large. The United States may well anticipate comparable. if not larger, benefits in the next few years in the Beaufort and Chukchi Seas off northern Alaska as exploration increases in the search for domestic sources of petroleum. It is imperative that timely Landsat data be provided to U.S. shipping in the Arctic.

One indication of the importance of Landsat images to energy related industries can be found by examining the types of organizations that purchase data from the EROS Data Center. This evaluation indicates that from a Forbes list of the top 500 U.S. industries, 113 are energy related, and 81 of these have purchased data from the EROS Data Center. Thirty-four of the 81 energy-related industries show a highly repetitive ordering pattern, either initiating new orders on approximately a monthly basis, or retaining standing orders for data as they become available.

EROS DATA CENTER

A major portion of the EROS Program activities are conducted at the EROS Data Center at Sioux Falls, South Dakota. This Center serves as a central archive for most Department of the Interior aerial photography, NASA aerial photography and space imagery acquired by NASA. The data base is automated to allow rapid inquiry for any of the data that are available. This data base is generated and maintained through a cooperative effort with the National Cartographic Information Center. Plans call for adding aerial photography and other remotely sensed data to the data base as it is acquired by the Geological Survey and NASA and to enter into agreements with other agencies to either archive their data or to reference it in the data base.

The Data Center has excellent photographic laboratories suitable for large volume photographic reproduction and special photographic processing. These photographic capabilities are used to reproduce imagery contained in the data archives to satisfy individual requests. The data are sold for a price that includes the cost of materials and labor to make the appropriate copies.

At present the major deficiency in the Data Center is in the inability to process the large amounts of electronic (high density digital tape) data that are planned for the near future. This capability is needed to improve the throughput time between acquisition of Landsat data and the time when users can receive their copies and to upgrade the quality of the data that is delivered to customers.

The Data Center building was designed with facilities for training. Training is conducted as a part of an applications assistance and technology transfer function. The Data Analysis Laboratory at the Center serves as a research, technique development and training facility. This laboratory has state-of-the-art equipment for analysis of electronic imagery.

Data Available

An important activity of the EROS Data Center is archiving, retrieving, reproducing and distributing remotely sensed data. Data currently archived at the Center exceeds 6,000,000 images, including over 600,000 frames of Landsat imagery ; Landsat electronic data in the form of computer compatible tapes; over 40,000 frames of Skylab, Apollo, and Gemini data; more than 1,800,000 frames of data from the NASA Research Aircraft Program; and almost 4,000,000 frames of Department of the Interior aerial mapping photography.

The demand for reproduction of these archived data has continued to increase both in number of frames and dollar value. In FY 73, 165,000 frames of data were suplied to the user community, data volume grew to almost 300,000 frames in FY 74, and has exceeded 400,000 frames in FY 75. At the same time, dollar income at the Center increased by 91 percent from FY 74 to FY 75, with total dollar income from the sale of data exceeding $1.6 million in FY 75 (table 1).

TABLE 1.–INCOME FROM VARIOUS DATA PRODUCTS PRODUCED BY THE EROS DATA CENTER DURING FISCAL YEARS 1973-75

	LANDSAT	Other satellite [1]	Aircraft	Total
Fiscal year—				
1973	$153, 000	$12, 000	$84, 000	$249, 000
1974	593, 000	44, 000	248, 000	885, 000
1975	930, 000	113, 000	567, 000	1, 610, 000
1976 estimate	1, 720, 000	140, 000	920, 000	2, 780, 000

[1] Gemini, Apollo, and Skylab imagery and photography.

Approximately 58 percent of the dollar value for products at the Center is for Landsat data. The customer profile for purchase of all data shows that private industry is the largest single purchaser, with 30 percent of the total dollar value, and agencies of the Federal Government coming next with 24 percent. Academic and educational institutions account for 16 percent of data sales, while foreign customers comprise 12 percent. Individuals, state, and local government agencies comprise the remainder.

Agricultural Related Training

A primary function of the EROS Data Center is to offer formal training on the utility of remote sensing techniques. Normally these training sessions are up to one week in length and stress the use of remotely sensed data in a practical application. For example, workshops given during 1974 and 1975 included:

(a) Digital analysis of Landsat data to assess spruce budworm defoliation for the Animal and Plant Health Inspection Service, USDA.

(b) Deterioration of rangeland and cropland conversion to rangeland for the Soil Conservation Service, USDA.

(c) Sampling frame construction using Landsat data for the Statistic Reporting Services, USDA.

(d) Renewable resource assessment for the Forest Service, USDA.

(e) Irrigated lands inventory for the Bureau of Reclamation. USDI.

(f) Rangeland Productivity estimation for the Bureau of Land Management, USDI.

Two or three times a year a three to four week course is offered to foreign nationals, stressing the fundamentals of remote sensing with enphasis on specific applications such as agricultural and soils inventory. To date there have been 132 attendees from 49 countries. Twelve African countries. 19 Asian countries, 9 European countries, 8 South American countries, and Australia have been represented. The five courses that have been conducted were in June 1973. June 1974, September 1974, May 1975, and September 1975. Also, training in foreign countries consisting of lectures. workshops. and seminars has been conducted by EROS Program personnel. Countries visited during Fiscal Year 1975 which involved agricultural related training included Australia, Algeria. Thailand, Mali, Mexico. and Ghana.

Data Analysis Laboratory

The Data Analysis Laboratory at the EROS Data Center provides specialized equipment and qualified personnel to aid users in the analysis of remotely sensed data, particularly Landsat images, for a variety of purposes. The sophistication and cost of image analysis equipment has made it desirable to centralize such facilities, so that they may be used at their maximum efficiency. Work at the Data. Analysis Laboratory is not restricted to scientists within the EROS Program. It is also available to all interested users from Federal, state and local government agencies. The philosophy under which the laboratory operates is that it accommodates users on reasonable schedules for demonstrations, experiments, and training in the computerized analysis of remotely sensed data in order to work out solutions to resource problems and to train users in the methods of data analysis.

Facilities of the Data Analysis Laboratory include the General Electric Image 100 Multispectral Analysis System, which is used for classification, analysis, and mapping, of resource environmental features from Landsat digital images and images from aircraft multispectral scanners; an Interpretation Systems Incorporated Analysis System, which allows the overlay of up to 73 repetitive images of a given area for analysis of time changes in natural and manmade features and a terminal to the computer facilities at the Laboratory for Applications and Remote Sensing at Purdue University for large area classification and mapping of land features using the LARS multispectral analysis system. Users experiment with the various facilities to find methods of solving particular resource problems of interest and importance to them, to determine the feasibility of various automated interpretation approaches, and when their experiments prove successful, they determine the means by which they would use such methods operationally in their resource management responsibilities. Technical assistance by experienced machine operators and resource scientists familiar with automated analysis is available to assist the investigators. The facilities of the Data Analysis Laboratory are also extensively used in training courses conducted at the EROS Data Center both for domestic and foreign users.

Interest in and use of the Data Analysis Laboratory has been widespread and has required a two shift operation, five days a week. Personnel are available to assist in the operation of the equipment and in suggesting approaches to the solution of their problems. During the four month period from July 1, 1975, to October 30, 1975, seventy-nine percent of the available time of the Data Analysis Laboratory was spent in working with users and demonstrating the use of the system to groups of trainees.

The Data Analysis Laboratory is providing users with access to sophisticated data analysis facilities and basic help on their use. This is a great help in creating a large corps of knowledgeable users of remotely sensed data who can apply such data to their resource management problems in the future.

CONCLUSIONS

Remote sensing technology has many direct applications to food production. Examples are crop inventories, plant vigor estimates, range capability and readiness measurements, and adverse effects on agriculture such as floods and disease. Food production depends on more than directly observable parameters. Climatology, mesoscale meteorological conditions, weather modifications, surface and subsurface water management, availability of energy, products derived from petroleum and other minerals and land use information are also major considerations for a modern food production program. Remote sensing technology has direct contributions to solving the problems related to each of these additional information and material needs.

Many capabilities of remote sensing have been demonstrated. Others are in the research stage. Still more areas of applications have not been started. The entire potential for using remote sensing technology cannot be adequately measured at this time. The demonstrated capabilities do, however, represent a major contribution toward achieving many information needs. More emphasis needs to be placed on physical models to turn data into useful information, and still more attention needs to be placed on using this information for real management decisions.

Agencies with operational responsibilities express three basic reasons for caution in becoming dependent on Landsat data. These are:

(a) Landsat is experimental. There is no assurance of continuity beyond about 1980, or even earlier if a spacecraft or launch vehicle fails.

(b) Data are not available soon enough to be used in making time-critical decisions.

(c) Standard photographic products contain less than the complete data content of the original digital data, thus precluding their use in some unique applications.

The last two of these reasons are technical. The solutions are known, within the resources available, and NASA and the EROS Data Center are augmenting their data processing and distribution systems to make the necessary improvements. The first deficiency relates to policy and the intention of the United States to continue in a leadership role in global Earth resources satellite programs.

An important factor, that is often overlooked, is becoming more and more apparent from our experience with the Landsat program. This factor is the unifying influence of a global data base with uniform characteristics that serves scientists in many discipline. The results are threefold: (1) scientists in different disciplines are communicating better and understanding the relations of their discipline to other Earth sciences; (2) international scientific communication has been improved, because scientists from all nations can obtain data of uniform characteristics and compare their results of analysis and analysis methods. The number of international applications examples using Landsat data that are discussed in this report illustrates the significance of this international communication; and (3) the availability of repetitive data of dynamic phenomena permits the establishment of wholly new types of scientific studies, many of enormous potential value to our understanding of the global *environ*ment.

Great possibilities exist for international cooperation on a mutually productive basis. The history of science may well record that the development of the NOAA and Landsat series of satellites and the ready availability of their data to all rank as one of the great achievements of the 20th century. These satellites that provide repetitive environmental and resource data for the entire planet may rank in the same class as the invention of the telescope or the microscope in providing man with a completely different view of himself and his planetary environment. Very few people, scientists included. truly appreciate the revolutionary significance of these satellites. As with all other great steps forward in technology and exploration, many years will pass before the total significance is grasped. It is important, therefore, that this gestation time be shortened, so that we may make more effective use of the environmental information sooner.

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[The following questions were submitted by Senator Humphrey to Dr. DeNoyer and his answers thereto:]

Question 1. You indicate a number of agencies in the Department of Interior have found the LandSat information useful in their management programs. Has the Bureau of Land Management found this information more comprehensive and more accurate, than comparable information obtained from other sources ?

Answer 1. The Bureau of Land Management has reported that it could make extensive use of Landsat imagery for monitoring the condition of grazing grassland, therein permitting re-evaluation of grazing leases and limiting the time and number of animal-unit months for each lease. The information would permit the rangeland manager to make a decision of lease or no-lease. This information would be far more accurate and comprehensive than present estimates based on visits at intervals of three years or more to some of the more remote regions of the Federal rangelands.

The Bureau of Land Management is preparing a project plan for an Applications System Verification Test (ASVT). The intent of this ASVT is use of remote sensing data as one of the data sources for a comprehensive information system that is being developed by the Bureau of Land Management.

Question 2. Would Landsat information be used primarily to replace information obtained from other sources, or primarily to supplement information from other sources?

Answer 2. Landsat provides an additional data source for most applications. Other types of data are often needed to carry out complete investigations. In some cases. Landsat provides unique capabilities that make new types of assessments possible. In still more cases. the short time required for analysis of Landsat data make this approach attractive for measuring dynamic characteristic of surface features. In strip mine monitoring, for example, the Geological Survey of

Indiana has used Landsat to monitor change that has occurred in the areal extent of strip mines since the region was mapped by conventional methods *in* 1968. In the analysis of geologic structure, Landsat permits regional landscape features to be related to regional faults and fractures systems which have been verified by field and aerial photographic methods. Landsat also permits the delineation of regional alignments of topography, streams segments, and other features, some of which are hundreds of kilometers in length and cannot be recognized except on Landsat imagery. Landsat is being used operationally in Nebraska to monitor the annual increase in the number of center pivot irrigation systems, which cannot be practically and economically performed in any other way.

Question 3. What, if any, agencies in the Department of Interior, have indicated that they would like to participate in, and share in the cost of, an operational Landsat program?

Answer 3. We are concerned about funding the space segment of a program of this type from many sources. The whole program might fail if any one contribution of funding failed to succeed *in* the budgetary process.

The EROS Program of the Department of the Interior would like to participate by providing for the ground segment of an operational Landsat system. The ground segment would include archiving of data, reproduction of data, and distribution of data to users. This type of participation will require substantial budget increases and close coordination through the entire budgetary process to ensure that both the space and ground segments of the program are funded adequately and on consistent time schedules. Accordingly, the Department of the Interior presently is reviewing its position regarding the role it might play in the ground segment of an operational Landsat system. ,

The following Department of the Interior bureaus have indicated that they would use data from an operational version of Landsat and would underwrite the cost of data analysis for applications within their bureaus:

Bureau of Land Management; Fish and Wildlife Service; Bureau of Reclamation ; Bonneville Power Administration; and U.S. Geological Survey.

Question 4. Which agencies do you expect in the future to make sufficient use of Landsat information to justify their sharing in the underwriting costs?

Answer 4. As implied in the answer to question 3, it would be desirable for a single agency to have implementation and funding responsibility for the space segment of a Landsat system. Those agencies indicated above, plus the Corps of Engineers, Department of Defense; Statistical Reporting Service, and Forest Service, Department of Agriculture; Bureau of the Census, Department of Commerce; and the Agency for International Development of the Department of State, would be users of data and could be expected to fund their own data use programs.

Question 5. What, in your opinion, are the major bottlenecks in the current Landsat experimental program?

Answer 5. The greatest bottlenecks in terms of operational uses are assurance of continuity of follow-on satellites similar to Landsat, quality of data provided to risers, timeliness or currency of data when it reaches the user and transfer of technology to users.

Question 6. What actions would eliminate these bottlenecks?

Answer 6. The assurance of continuity would require a commitment by the United States and appropriate funding levels to support an operational program. Steps are being taken by NASA and the Department of the Interior to solve the data quality problem. These steps involve implementing complementary digital data proressing systems which will permit production of higher quality products for specific applications, and digital data that retain all the information acquired by the satellite. Technical solutions to the timeliness problem are known but actions are progressing slowly because of insufficient fiscal and personnel resources. Limited efforts to transfer the technology to users have been very successful. Additional efforts could be undertaken to the extent that resources become available.

Question 7. What plans does the Geological Survey have for continued cooperation with other countries in the use of Landsat information?

Answer 7. Two or three times a year, a 3- to 4-week course is offered at the EROS Data Center to foreign nationals, stressing the fundamentals Of remote sensing with emphasis on specific applications. To date there have been 132 attendees from 43 countries. Training in foreign countries consisting of lectures, workshops. and seminars have also been conducted by EROS Program personnel at no travel cost to the Department. This is indicative of the international need and interest in remote-sensing training. Countries visited during FY 75 included

Australia, Algeria, Thailand, Costa Rica, Venezuela, Mali, Mexico, and Ghana. Sources of funding have been the governments of Australia, Algeria, and Mexico, and Economic" and 'Social Commission for Asia and the Pacific of the United Nations (ESCAP), U.S. Information Agency (USIA), and U.S. Agency for International Development (USAID).

Twenty percent of the dollar value of Landsat data produced in FY 75 at the EROS Data Center was for foreign users, and this level is expected to continue. To date, 127 foreign countries have procured Landsat data from the EROS Data Center. In addition a significant part of the Landsat data production for U.S. industry is for oil and mineral exploration by U.S. companies overseas.

Question 8. Which, if any, countries would be willing to participate in, and share in the cost of, an operational Landsat program?

Answer 8. We have had many contacts with foreign countries that are interested in participating in the Landsat program Any agreements are negotiated by NASA. NASA can provide the most complete answer at this time. We are aware of the agreements for two stations in Canada and the stations and plans for stations in Brazil, Italy, Iran, Zaire, and Chile. The agreements that NASA is signing with these countries provide for sharing the cost of follow-on Landsat systems. We are also aware of interest in building ground stations by Upper Volta, Norway, Australia, India, Japan, Indonesia, and Saudi Arabia.

Chairman HUMPHREY. We have one additional witness from the agencies, Dr. Hill, who is project manager of LACIE, Department of Agriculture. We will proceed with you now, and then Dr. Park.

STATEMENT OF DR. HOWARD HILL, PROJECT MANAGER, LACIE, U.S. DEPARTMENT OF AGRICULTURE

Dr. HILL. Mr. chairman, I welcome the opportunity to report to the Technology Assessment Board on the application of advanced technologies by the Department of Agriculture. Providing current and reliable food, agricultural, and nutrition information is a first concern for the 'Department of Agriculture. There are many users of this information. They include the general public, Federal and State agencies and the Congress, and international organizations and foreign governments.

The Department's primary interest in advanced technology is as a user of its services. As advanced technologies make more systems available, we are striving to put them to use to accomplish the Department% objectives. The remote sensing user requirements task force created in 1973, has specific responsibilities to help the Department to meet its future needs for remote sensed information.

The task force was directed to catalog the Department% requirements of earth resources data, determine those requirements that would return maximum benefits, and develop a coordinated plan for acquiring processing, analyzing, and distributing data to meet those requirerments.

Last year the task force completed its cataloging of the Department% remote sensing information requirements. More than 2,000 items of information were identified as being potentially collectable by remote sensing techniques that would be useful in carrying out the Department% program.

The next step was to analyze these requirements in terms of priority of need and available technology. Those requirements which Show near-term promise of satisfaction and maximum net benefits will receive first consideration for being filled.

The task force will next study the cost-effectiveness of applications which are identified as being technically feasible to implement, and having a potential for significant benefits. Finally, a plan for research, development, and implementation will be submitted to the Secretary.

Now" I would like to summarize for you the analytic and communication technology already being used experimentally and operationally by USDA agencies with primary concern for preparing and reporting information on food, agriculture, and nutrition.

The Large Area Crop Inventory Experiment—LACIE—is an excellent example of USDA's continuing efforts to exploit advances in technology in improving its food and agriculture information systems in that it integrates a number of technologies into a comprehensive system.

The LACIE is an experiment to test the technical feasibility and cost effectiveness of utilizing data from an Earth resources satellite along with meteorological, climatological and historical data to predict production of a major agricultural crop. The experiment is being carried out jointly by the .National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, and the U.S. Department of Agriculture. USDA is participating in this experiment primarily as a prospective user of an operational crop-reporting and forecasting system. Wheat was selected as the test crop.

Within USDA, six agencies are participating in LACIE under Foreign Agricultural Service—FAS—leadersl~ip.

L.ACIE is being carried out in three phases. Phase 1, carried out in 1975, tested acreage estimating capabilities in selected wheat producing areas of the United States. Wheat yield models were developed and tested during this phase. Phases 2 and 3 will test LACIE capabilities to estimate wheat area, yield, and production in the United States and other wheat-producing regions. Phase 2 began in October 195 and will continue through this year. Monthly crop forecasts will be prepared during the growing season. Associated research and development and tests of new techniques for crop identification measurement and yield estimation will be conducted throughout the experiment.

It is important to stress that LACIE is an experiment, and recommendations for future program. use will be based on the outcome of evaluations that are made as the experiment proceeds.

USDA has lead responsibility for evaluating crop estimates in relation to USDA requirements, for analyzing costs and benefits of an improved crop forecasting capability, and for designing a user system for post-LACIE implementation. We foresee application of LACIE-proven techniques by analyst teams that use readily available hardware and software.

Design of the user system was started recently with the target of completing design and testing in time to implement LACIE at the end of the present schedule, if experimental results support that course of action. Because of its position as the eventual user agency of an operational system, USDA has broad responsibility for defining output requirements and for integrating this output, as appropriate, with ongoing programs.

Although LACIE now is limited to wheat, it is expected that programs and techniques developed during the experiment can be applied to the estimation of other agricultural crops and land use. If successful and if found to be cost effective, a crop-forecasting system utilizing the earlier mentioned technologies would provide better and more timely crop estimates as inputs to the Department's international crop information collection and reporting system.

The Department has several longstanding programs for collecting and distributing information on food, agriculture, and nutrition. Each of these programs uses advanced technology where appropriate, in carrying out that function. The FAS relies heavily on its Agriculturalattache reporting system for information about the supply and demand for agricultural products in countries around the world.

As the volume of information about foreign production, imports, exports, consumption, and stocks has grown, FAS has made greater use of computer services to store and retrieve this information as well as for analysis. The FAS plans to use advanced technology through interactive computer terminals in its commodity divisions, thus enabling their analysts to have more current information when it is needed and facilitate statistical analysis and econometric modeling.

FAS also hopes to be able to employ advanced techniques associated with intercontinental message switching and data transmission to improve attache information collection and reporting. The actual use of these technologies. however, will depend upon the outcome of a future cost-benefit analysis and the avaliability of funds for such a project.

Since the launch of Landsat 1 in 1972, the Statistical Reporting Service-SRS--has studied its potential use for collecting agricultural information. Work to date has been mainly to identify crops and estimate crop acreage from Landsat imagery.

The approach used by SRS is described at greater length in my full report, but their work so far shows measurable results using both Landsat and aerial photography. Potential applications include using remote sensed information to supplement or verify existing ground survey procedures.

Timely economic information on the agricultural sector has taken on greater value to decisionmakers as U.S. agriculture moves away from controls and comes more directly under the influence of domestic and foreign economic conditions.

More realistic models of the agricultural economy are being developed by the Economic Research Service applying computer technology which permits analysis of the complex interrelationships within agriculture, and between agriculture and the domestic and world economies. The models are discussed at greater length in the full report but basically consist of shorti-term commodity-forecast models and long-term economic-projections models.

In summary, we produce information on food, agriculture, and nutrition at many points in the Department of Agriculture. Advanced technology is being used in the production of this information where it is feasible to do so, as evidenced by greater efficiency or expanded capability to carry out the function.

Advanced technology offers many opportunities for improving service to information users. Increasingly, utilization of technology requires integrated application of two or more kinds of technologies. The LACIE is an example of this trend. Meeting the LACIE objective of accurate and timely crop reports on a worldwide basis will reeqire, the integration of satellite, computer, and communications technology. Some of the same technology is being tested for application to domestic crop reporting in con-junction with conventional survey methods.

The objective in both instances is to improve the Department's capability for producing accurate and timely crop reports, and to do so in a cost-effective manner.

Computer and communication technologies also are being more widely used by the Department. More realistic models of the agricultural economy are possible by applying computer technology to such uses as short- and long-term economic forecasts, and evaluation of alternative future conditions that might occur. These analyses would not be possible without the support of computerized data bases and models.

These technology applications, and other information activities that rely on more conventional method, are employed for the purpose of responding more effectively to pertinent questions about our food and fiber production and distribution system, and for helping to anticipate future problems bearing on the system's performance.

Thank you.

Chairman HUMPHREY. Thank you.

[The prepared statement of Dr. Hill follows:]

STATEMENT OF DR. HOWARD L. HILL, LACIE PROJECT MANAGER, FOREIGN AGRICULTURAL SERVICE, U'. S. DEPARTMENT OF AGRICULTURE

Mr. Chairman, I welcome the opportunity to expand our remarks regarding the recommendations presented in "Food, Agriculture, and Nutrition Information Systems: Assessments and Recommendations." In particular, you have requested that we respond with a detailed description of the relevant activities of our agency that deal with the application of advanced technologies.

The preparation and distribution of current and reliable food, agricultural, and nutrition information continues to be a first concern for the Department of Agriculture. Although increased crop production has, to a certain extent, alleviated the tight supply situation of a year ago, the needs of the future are clear: increased food production in this country and overseas, especially in the developing world. Reliable information on present agricultural production and markets is essential for measuring progress toward this goal, and for planning and decision-making for future production and distribution, foreign trade and transportation.

The Department's primary interest in advanced technology is as a user of its services. Advanced technology, such as computers and modern research equipment, is routinely used by the Department in its research and action programs. As advanced technologies make more systems available, we are striving to put them to use to accomplish the Department's objectives in these areas.

REMOTE SENSING USER REQUIREMENTS TASK FORCE

In mid-1973, as part of the Department's continuing efforts to apply advances in technology to improving the information available to decision makers both within and outside the Federal government, the Secretary created a Remote Sensing User Requirements Task Force with representatives from 8 Department agencies which use remote sensing (R/S) in carrying out their programs. Representatives from several other Department agencies and NASA were also appointed to the Task Force to provide technical assistance in such areas as benefit assessment, information systems requirements, integration with research programs, and technical hardware capabilities.

The Task Force was directed to catalog the Department's requirements of earth resources data, determine those requirements that would return maximum benefits, and develop a coordinated plan for acquiring, processing, analyzing, and distributing data to meet those requirements. The coordinated plan will evaluate the potential for incorporating R/S-acquired data into ongoing programs and information systems, and will provide information on benefits and costs, resource requirements, technology capabilities, and other information needed by the Department on how to make effective use of R/S technology to obtain needed information.

The Task Force has now completed its cataloging of the Department's remote sensing information requirements. More than 2000 items of information were identified as being potentially collectable by remote sensing techniques that would be useful in carrying out the Department's program. Included were such diverse items as information on timber species, wildlife migration, volume of sediment in waterways, soil features, world agricultural crop production, and others. These requirements were entered in an automated data base which allows the Task Force to identify commonality of requirements among USDA agencies and to provide management with information on data essential to decision making.

A Task Force implementation analysis team made up of specialists from the USDA, NASA, Department of the Interior, and Universities has analyzed these requirements in terms of priority of need and available technology. Requirements were grouped according to technological status (research, development, operational). Those requirements which show near-term promise of satisfaction and maximum net benefits will receive first consideration for being filled.

The Task Force will next study the cost effectiveness of applications which are identified as being technically feasible to implement, and having a potential for significant benefits. Finally, an integrated research, development, and implementation plan will be submitted to the Secretary.

The remainder of this report will focus on remote sensing, analytic and communication technology already being used experimentally or operationally by USDA agencies with primary concern for the preparation and reporting of information on food, agriculture, and nutrition. The use of advanced technologies gives a clear picture of the important. role we attach to these programs.

DEPARTMENT USES OF ADVANCED TECHNOLOGY

LACIE Program

In recent years, shortages of agricultural commodities have been serious in some countries and have become a concern to all. Uncertainty about crop prospects has impacted on livestock production, commodity prices, consumer prices, trading patterns, and trade balances. One outcome of these developments is a sharp increase of interest in crop forecasting and in exchanging information about crop production conditions.

Emerging technology holds promise of providing the means to quicker, more accurate assessment of crop production prospects, particularly for foreign countries. In particular, prospects appear strong for assessing crop conditions via remote sensing of crop growing areas and through analysis of weather and climatic factors affecting crop growth. TheLarge Area Crop Inventory Experiment (LACIE) is an excellent example of USDA'S continuing efforts to exploit advances in technology in improving its food and agriculture information systems in that it integrates a number of technologies *into* a comprehensive system.

The Large Area Crop Inventory Experiment (LACIE) is an experiment to test the technical feasibility and cost effectiveness of utilizing data from an earth resources satellite along with meteorological. and climatological and historical data to predict production of a major agricultural crop. The experiment is being carried out jointly by the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Agriculture (USDA). Each agency brings its unique capabilities to this project and seeks, in turn, to fulfill some part of its overall mission responsibilities. USDA is participating in this experiment primarily as a prospective user of an operational crop reporting and forecasting system. Wheat, a food crop of major importance, has been selected as the test crop for LACIE.

Within USDA, LACIE is a multi-agency effort. Six agencies are participating, and have contributed professional staff with specialized skills to the experiment. The Foreign Agricultural Service (FAS) has been designated as the lead agency; other participating agencies are Agricultural Research Service (ARS), Agricultural Stabilization and Conservation Service (ASCS), Economic Research Service (ERS), Soil Conservation Service (SCS), and Statistical "Reporting Service (SRS).

LACIE will be carried out in three phases. Phase 1. carried out in 1975, tested acreage estimating capabilities in selected wheat producing areas of the United States. Wheat yield models were developed during this phase. Phases 2 and 3 will test LACIE capabilities to estimaite wheat area, yield, and production in the United States and other wheat producing regions. Phase 2 began in October1975 and Phase 3 begins October 1976. Monthly crop forecasts will be prepared during the growing season. Associated research and development and tests of new techniques for crop Identification measurement and yield estimation will be conducted throughout the experiment. The project is being monitored by the participating agencies; however, USDA has lead responsibility for evaluating crop estimates in relation to USDA requirements and for analyzing costs and benefits of an improved crop forecasting capability. Because of its position as the eventual user agency of an operational system, USDA has broad responsibility for defining output requirements and for integrating this output, as appropriate, with ongoing programs.

It is important to stress that LACIE is an experiment, and recommendations for future program use will be based on the outcome of evaluations that are made as the experiment proceeds.

USDA also has lead responsibility for designing a user system for post-LACIE implementation. We foresee application of LACIE-proven techniques by analyst teams that use readily available hardware and software. Design of the user system was started recently with the target of completing design and testing in time to implement LACIE at the end of the present schedule, if experimental results support that course of action.

Although LACIE now is limited to wheat, it is expected that programs and techniques developed during the experiment can 'be applied to the estimation of other agricultural crops and land use. If successful and if found to be cost-effective, a crop forecasting system utilizing the earlier mentioned technologies would provide better and more timely crop estimates as inputs to the Department's international crop information collection and reporting system.

Quicker and better information *on* world crops could: (1) help the United States and other countries to manage better agricultural production and to minimize fluctuations in price and trade volumes; (2) provide earlier warnings of crop shortages due to adverse weather; (3) provide timely indications of crop diseases and insect infestations which could affect world food supplies; and (4) provide improved production and supply information to international organizations such as the Food and Agriculture Organization for use in carrying out their responsibilities.

If a decision is made to make LACIE operational, the requirement of a system with a capability to provide routine repetitive international crop forecasts would require a continuing flow of earth resources and meteorological data which are available to the user within a short time after acquisition, and are repeated at frequent intervals throughout the growing system, and are suitable for computer processing and analysis. Of course, a decision to implement a crop forecasting system at the end Of LACIE is also contingent on a determination that the infer. mation generated is sufficiently accurate, timely and cost-effective to warrant an investment in such a system.

LACIE is a large and technically complex undertaking, involving close cooperation between two Departments (Agriculture and commerce) and one independent agency (NASA) : and several agencies within each of the Departments. The present experimental approach should, in time, be replaced by a user system capable Of applying current technology and the advanced technology now planned for the 1980's. Thus LACIE is providing an environment both for testing technology-including future technology relevant to crop identification and yield forecasting—and for determining how best to utilize modern analytic capabilities in carrying out an information function.

Foreign Agricultural Service

The backbone of the Foreign Agricultural Service information system is its Agricultural Attache Reporting System, which relies on attaches stationed in 63 posts around the world reporting on 82 countries. *In* the current world environment of short food stocks and production shortfalls, the intelligence collected by this network is vital. In many cases, it is the only source of information about the supply and demand for agricultural products in foreign countries around the world.

It is necessary to aggregate, process, and summarize to a great extent the high volume of detailed information concerning foreign production, imports, exports, consumption and stocks to get a meaningful picture of existing world stocks of food and feed grains and the potential demand for U.S. agricultural products. The Foreign Agricultural Service utilizes a computer system for storage and retrieval of this information as well as for statistical analysis and simple modeling to support its Foreign Commodity operation.

The Foreign Agricultural Service plans to make future use of advanced technology where it is both cost effective and funded. Plans include making FAS computerized information systems more readily accessible to economists and commodity analysts through interactive computer terminals in commodity divisions. This will allow FAS economists to have more current information when it is needed and facilitate statistical analysis and econometric modeling.

FAS also hopes to be able to employ advanced techniques associated with intercontinental message switching and data transmission to improve attache information collection and reporting. The actual use of these technologies, however, will depend upon the outcome of a future cost benefit analysis and the availability of funds for such a project.

Statistical Reporting Service

Since the launch of LANDSAT 1 (ERTS 1) in 1972, the Statistical Reporting Service has conducted a continuing research program to investigate the potential use of this imagery as a tool for Collecting agricultural information. The primary thrust of the work to date has been in the area of crop identification and the development of methods to estimate crop acreages from LANDSAT imagery. Key components of this system under study are: (1) design and development of a flexible automated computerized data handling system for data conversion, calibration, interpretation, pattern recognition and statistical analysis: (2) development of a multi-stage sampling design that will utilize LANDSAT data, ground observations and related data in the estimation Process; (3) analyzing data acquired considering accuracy, data acquisition cost, coverage and availability, for optimizing number and size of ground sample segments; (4) evaluation of alternative land use and crop classification systems using LANDSAT data for improving current SRS sampling frames; and (5) comparisons of crop identification and classification results from high altitude aircraft photography and LANDSAT to determine potential improvements in classification that could occur with better resolution satellite imagery.

Research results show that LANDSAT classification accuracy for crops is closely related to field size, field shape and diversity of crops produced. Accuracy ranges from about 90 percent for Southwest Kansas with 4 crops down to 40 percent for Central Idaho with 12 crops. Classification accuracy was improved, ranging to about 80 percent for 15 crops in Idaho, when higher resolution aerial photography was used. However, operational problems related to handling large volumes of data in such a system must be resolved before it can be tested for a large area.

Computer software has been developed that can match and retrieve LANDSAT data and corresponding ground truth sample data and estimates. This system allows LANDSAT information to be correlated with ground truth data obtained from routine field surveys.

The correlation (R) of LANDSAT data and SRS ground truth data for identical areas ranges from .5 up to .8. We believe that the LANDSAT data can be used to improve existing acreage estimates. Further study will be conducted to test this theory for other areas of the country and to develop cost estimates for the potential improvements using LANDSAT and other survey procedures.

LANDSAT data will be processed on the ILLIAC IV Computer (a parallel processing system using 64 computers linked together and a separate computer serving as the Central Processing Unit). This computer can process over 7,000.000 pixels (data points) in about 12 minutes. A digitizer that generates a system Of coordinates is used to extract sample segment data from LANDSAT frames (tapes) for correcting classification errors, using ground truth acquired by personal enumeration of sample segments.

Problems that must be resolved ‘before this technology can be put into any operational system include: (1) earlier availability of LANDSAT tapes, (2) improvements in the ability to extend crop signatures between LANDSAT frames, and (3) refinements in specified crop signatures that will improve . classification and measurement accuracy.

The use of photography for making orchard tree and fruit counts also is being researched. A computer model uses digitized information from aerial and ground photographs. Results show that fruit trees as well as mature oranges, apples and peaches can be successfully counted from data obtained from photographs. The tree counts can be used in sample surveys to estimate tree populations while the automated fruit counting system can be used in a multi-stage sampling design to more precisely estimate the number of fruits per tree.

Economic Research Service

The Economic Research Service provides economic information on the agricultural sector to public and private decision makers. The task has become more difficult as U.S. agriculture moves away from controls and comes more directly under the influence of domestic and foreign economic conditions. ERS has recognized the need to apply advanced techniques to problems of data management and it recently centralized its automatic data processing services into one unit, consisting of a data storage system linked to a generalized analytical package for estimating relations, making variable transformations, plotting data, and conducting statistical analyses. This technology will aid analysts by reducing the time required to conduct an analysis while increasing the amount of data which can 'be analyzed. Quality and timeliness of the analyses will be improved and other agricultural analysts will be able to more quickly retrieve data from the system. Ultimately, this will benefit the decision maker through improved information on which to base decisions,

Agricultural Modeling System

More realistic models of the agricultural economy can be developed by application of computer technology which permits analysis of the complex interrelationships within agriculture, and between agriculture and the domestic and world economies. To assist in analyzing these interdependencies, ERS is developing a cross-commodity modeling system of the agricultural sector.

It is composed of commodity subsector models linked through common variables to form a modeling system. Thus, when facts change which influence one commodity subsector the impact this has on other related commodities can be measured.

Currently, this modeling system is composed of individual models for beef, pork, dairy, chickens, eggs, turkeys, corn, oats, barley, grain sorghum, soybeans, and wheat.

The livestock and grain models have been linked and the others are in the process of being linked. In addition, models for cotton, tobacco, and selected fruits and vegetables are being developed and will subsequently 'be linked.

Such a modeling system will make available an analytical capability previously not available and allow ERS analyses to reflect more of the total impact of various changes on agriculture.

Economic *Projection Program*

The ERS is developing a man-machine simulation of the domestic and world food and agricultural systems of which the principal computerized components include:

(1) The National Interregional Agricultural Projections system (NIRAP), which is the core projections capability and point of coordination for all ERS food and agricultural projections. This system contains basic supply-demand relationships in domestic food and agriculture.

(2) The world Grains, Oilseeds and Livestock (GOL) trade model which projects major world trade relationships in food and agriculture. This model can be run independently or in concert with the NIRAP system.

(3) A linear programming model of interregional transportation of farm commodities and interregional 'adjustments in farm production given specified environmental constraints. This model can be run independently or in concert with the NIRAP system.

(4) A rural economic development simulation model developed to analyze impacts of different national growth policies on employment and income in rural America. This model currently operates independently from the NIRAP system.

The program functions in two annual cycles, development and analysis. Feedback from previous 'analysis cycles provides the basis for changing existing models or developing new ones.

This information is used to operate component models of the NIRAP system from which are generated preliminary projections and analysis of alternative futures, which are reviewed and revised as needed prior to their actual use to answer futuristic questions in food and agriculture.

SUMMARY

Information on food, agriculture, and nutrition is produced at many points in the Department of Agriculture. Advanced technology is being used in the production of this information where it is feasible to do so, as evidenced by greater efficiency or expanded capability to carry out the function.

This report concentrates on Department information activities which utilize or experiment with advanced technology for collecting, analyzing, and distributing information on food, agriculture, and nutrition. The information thus developed is widely used by the general public, by public agencies for policy and program decision making, and for analyses of agricultural and resources issues

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faced by the Congress. Information produced by the Department also is used by international organizations and foreign governments. The kinds of information and the principal users are discussed at greater length in reports provided earlier to the Technology Assessment Board.

Advanced technology *offers* many opportunities for improving' service to information users. Increasingly, utilization of technology requires integrated application of two or more kinds of technology. The Large Area Crop Inventory Experiment (LACIE) is an example of this 'trend. Meeting the LACIE objective of accurate and timely crop reports on a worldwide basis will require the integration of satellite, computer, and communications technology in a cost-effective manner. Some of the same technology is being tested for application to domestic crop reporting in conjunction with conventional survey methods. The objective in both instances is to improve the Department's capability for producing accurate and timely crop reports, and to do so in a cost-effective manner.

The potential for using remotely sensed information in fulfilling the Department's responsibilities is being systematically assessed by the Department's Remote Sensing User Requirements Task Force. A large number of such uses have been identified. The uses vary in their importance. Practical considerations such as funding, supporting technology requirements, staff expertise, and technical attributes of the collection system, require that priorities be set among the uses to be met.

Computer and communication technologies also are being more widely used by the Department. More realistic models of the agricultural economy are possible by applying computer technology to such uses as short and long-term economic forecasts, and evaluation of alternative future conditions that might occur. These analyses would not be possible without the support of computerized data bases and models.

Communication technology plays a large role in the information function as the need for timely analysis and reporting on a worldwide basis becomes generally accepted. As the potential of the technology is more thoroughly studied additional applications are expected.

These technology applications, and other information activities that rely on more conventional methods, are employed for the purpose of responding more effectively to pertinent questions about our food and fiber production and distribution system, and for helping to anticipate future problems beating on the system's performance.

[The following questions were submitted by Senator Humphrey to Dr. Hill and his answers thereto:]

Question 1. What specific programs of the various agencies of USDA could be operated more efficiently if remote sensing data were available on a continuing basis?

Answer 1. Since the Department is a long-time user of aircraft data, we assume that your question refers to remotely sensed data from space. The Department's Remote Sensing User Requirements Task Force is currently examining the Department's needs for remotely sensed data in the carrying out of its responsibilities. The Task force assignment is approximately 50 percent complete. Until the Task Force has completed its assignment and has issued its final report, we cannot fully answer this question.

However, we believe that a prime beneficiary of the continued availability of remotely sensed would be the Department's food and agricultural information systems. The frequent "looks" at major crops around the world should permit more timely assessments of major crop area, condition, yield, and expected production as inputs to the Foreign Agricultural Service's crop forecasts. This improved information in turn could permit more rational decisions by the Department's program managers.

The Large Area Crop Inventory Experiment (LACIE) experience should also help to answer this question.

Question 2. What major improvements in agency programs are anticipated, if and when such data are available on a continuing basis?

Answer 2. The input of remotely sensed data from space to the Department's international crop forecasting system should provide both Federal and non-Federal users with more timely and accurate international crop production forecasts. Also, we are optimistic that use of remotely sensed data will provide earlier indications of insect infestations, crop diseases, or weather phenomena, which could adversely impact world crop production. It is also anticipated that remote sensing data could be used to supplement the Department's domestic crop reporting system. We should be able to amplify our response to this question when the Remote Sensing Task Force Report is available.

Question 3. What new or special problems would USDA expect to have to deal with to utilize such data?

Answer 3. In an operational use of remote sensing data, some potential problems can be assumed. These include: (1) precise registration of the' remotely sensed data to geographic coordinates (ground location), (2) timely delivery of the remotely sensed data to the user, and (3) problems associated with the rapid processing and analysis of the extremely large amounts of data contained in Landsat type scenes.

Upon completion of LACIE, we should be able to provide a more complete answer.

Qucstion 4. What, if any, institutional obstacles would need to be overcome if such data were available on a continuous basis?

Answer 4. In general, it would seem that several institutional issues would include: requirements on existing USDA organizations in order to integrate include: requirements on existing USDA organizations in order to integrate remotely sensed data into existing information systems; location and management of remote sensing preprocessing, processing and analysis hardware and personnel; organizational and management consideration involved in interfacing special purpose equipment with the Department's general purpose computers; and budget allocation to support the remote sensing activities.

Question 5. How would satellite data integrate with the current traditional data system ? (i.e. Displace, compliment, or supplement) Which data series would be most affected?

Answer 5. We are able to make some statements about the probable integration of information from an operational LACIE type system. We foresee opportunities to both complement and supplement USDA's crop production information system. Present non U.. S. crop production data series would be affected by the introduction of crop data that are collected on a timely basis, and are more accurate than present data. However, we do not foresee that these data could be produced entirely from I,ANDSAT information-there would still be dependence on existing data sources and on meteorological data.

Question 6. Has USDA, as a result of the first year of the LACIE experiment, been able to pinpoint additional research needs to increase the utility of this technology for USDA's usage requirements?

Answer 6. Technology areas that need to be strengthened were identified in the first phases of LACIE, and are intended in the evaluation report of Phase I which is expected to be appraised and released in the near future. The evaluation was carried out and reported by a LACIE team made up of staff from USDA, NOAA, and NASA. USDA resources available to LACIE will be applied to the solution of these technology problems wherever possible during the remainder of LACIE : in addition, fundamental problems requiring longer term research attention will be identified as LACIE continues. There is already a NASA-funded research program that supports LACIE, and we expect also to identify problems that fall within the area of USDA research concern.

Question 7. Could you provide OTA with a copy of the report of the Remote Sensing Use and Requirements Task Force?

Qiestion 7. It is expected that the Task Force will complete its task and issue its final report about the first of 1977. Copies will be forwarded to the OTA upon publication.

Question 8.. Could you provide OTA with a copy of the first years LACIE study ?

Answer 8. The LACIE Phase I Evaluation Report, mentioned above, is currently being reviewed for approval. Upon approval and publication, we will forward copies to the OTA.

Question 9. Are USDA's cost effective studies taking into account the international elements?

Answer 9. Yes. In evaluating the cost effectiveness of LACIE, among other elements, we plan to address the question of the value of improved international crop production information to decision makers—both within and outside the Federal Government, consumers, and producers. At this time however, there are no plans to appraise the value of improved information to non-U.S. Governments and/or organizations.

Question 10. Your paper deals with several other technologies used in information systems. OTA would appreciate knowing:

(a) Which models are being used or drawn upon by USDA for policy making purposes ? How would YOU suggest the Congress use these models?

(b) What fire the strengths and weaknesses of the principal modeling tools used by USDA?

(c) How much is being spent on modeling by USDA? What would be the effects of increase in the order of two-three times?

(d) Does the private sector make better use of modeling techniques than the U.S. Government ? How?

Answer 10. Testimony before the Office of Technology Assessment by Howard L.. Hill on F'ebruary 4, 1976, provided some brief overview of economic modeling activity in the Department of Agriculture. Nest of this activity is in the Economic Research Service (ERS) and is an integral part of their capability . to provide current forecast, and long range projections information on food and agriculture. None oil the information provided regularly by ERS depends solely on economic models but these tools are increasingly important in the work of this Agency.

Quentin M. West, ERS Administrator, testified before the Office of Technology . Assessment on September 25, 1975. His testimony provided an overview of what ERS has been doing in the past three years to Improve their analytical capability including modeling, improve output of information and improve the flow of data to use in analysis.

Most of the models used in USDA for helping to provide information to policy makers are developed internally by Department staff or in cooperation with economists at land grant universities. The primary model of the general economy being used by the Economic Research Service is the one developed by Wharton Econometric Forecasting Associates. The ERS long range projections activity relies primarily on the National Interregional Agricultural Projections (NIRAP) System and various university models. These models concentrate on different subject matter, different levels of detail and aggregation and different time periods from the next year to the next 20-30 years. The models attempt to capture the underlying structure and economic relationships of agriculture, such as the interrelationships between commodity sectors and between general economic activity and agriculture.

Economic models in the Department use the various modeling tools available. These include econometrics, statistical analysis, simulation, input-output, and mathematical programing. These tools have different strengths and weaknesses and are therefore applicable under different circumstances. In all modeling efforts, the foundation has to be a well-trained and informed staff and availability of data that allows appropriate use of the modeling tools. Understanding the economic issues and problems, making sound assumptions for significant factors not included in the models, such as informed opinions of industry contacts, and objective and clear interpretation of results from the modeling efforts require the well-trained and capable staff.

Some of the principal weaknesses of current modeling efforts include the need for more quarterly models, incorporation of some data on such important factors as weather, and improvement of models on agriculture in foreign countries.

About 15 percent of ERS budget is associated with the development and use of models. Having a significant increase in funds available for formal modeling work should have high benefits since a great deal of modeling work remains to be done.

Private industry uses basically the same modeling techniques as USDA. In fact, most of the models developed and used by USDA must be more comprehensive than those found in industry. The one area that private industry has been ahead of USDA is in using current computer technology *to* manage the volumes of data needed in economic analysis. ERS is currently making necessary improvements in this area and developing more powerful automated data management and analysis capabilities. This change was covered in Quentin West's testimony of September 25,1975.

Chairman HUMPHREY. Gentlemen, we thought it would be beneficial to have someone outside of the Government also make a presentation, We will next hear from Dr. Archibald Park of the Earth Satellite Corp.

STATEMENT OF DR. ARCHIBALD PARK, EARTH SATELLITE CORP..

l)r. PARK. Thank you, Mr. chairman.

I appreciate the opportunity to appear here, Mr. Chairman.

Chairman HUMPHREY. Would you tell us a little bit about the Earth Satellite Corp.; it is private ?

l)r. PARK. Yes. It is a private consulting firm. The bulk of our business is related to remote sensing and the application of it to resource management. our clients run the gamut from agribusiness both in this country and abroad to State and local governments here in this country as well as foreign governments in a consulting capacity.

I have been given a rather enviable task of being able to sit back and look at the research that has been conducted. And a friend of mine posed the philosophical question extremely well.

He said we should look at the research from time to time to see if we have already gone by the answer. In this case, I think there is sufficient evidence in the program of the experiments that have been done to date to point out that certain results that bear very much on operational go or no-go policy have in fact come to light.

M-y paper is quite long and covers the technology in some detail based on a system design. That is, an information system design that covers all aspects of data acquisition, data processing, data analysis, the various models that are in use today and of course, the decision-making process.

The staff asked me to comment on the technical and technological opportunities and constraints that exist today in the research and development programs and the opportunities for the future for the employment of such a system for global agricultural information.

The acquisition covers the three satellite systems that have been mentioned and I don't think it is of any use to speak further on them.

The document covers Landsats, Metsats and Datasats. It also covers collateral observations and measurements both by national governments and by international organizations as well as agribusiness.

It treats the Landsat satellite, I think, with the emphasis that it deserves since it is a key to this system. In my opinion. the system really cannot exist in a way that "is both unbiased and independent without such satellites. And I will have some recommendations at the end of my presentation that deal with what might go on from here.

There are various categories of data from Landsat. The following observables are all essential to an agricultural information system:

GROUP 1

1. Agriculture versus nonagriculture.
2. Cereals versus other crops.
3. Wheat versus other cereals.

GROUP 2

1. Soils association maps.
2. Soils reconnaissance maps.
3. Soils survey maps.

GROUP *3*

1. Vegetation density.
2. Vegetation vigor.
3. Vegetation stress.

The groups are in order of technical difficulty.

My position with respect to the operational decision is based on the premise that we already know how to make maps of agriculture versus nonagriculture on a global basis. That is not a R. & D. activity;

Chairman HUMPHREY. You mean agricultural and nonagricultural lands?

Dr. PARK. Yes, sir; I do.

As Mr. Mathews pointed out, this is going to improve with newer sensors on future satellites. That is, the precision will improve.

It can detect soil color. It can detect plant stress. It cannot tell you " what that stress is caused by, but conventionally it is caused by moisture or insects or disease or a combination of those.

It can measure biomass, that is the mass of the vegetation and, of course, it can say something qualitatively about plant vigor.

In addition to these observable, it is necessary to consider the interpretation of these data by skilled agricultural professionals in the appropriate scientific discipline. The following are the outputs of the Landsat and Landsat combined sources of data:

1. Ecological partitioning of the agricultural land of the world.
2. Surface soil mapping.
3. Crop inventory and monitoring.
4. Agricultural land use change detection.
5. Global agricultural data base compilation and update.

The inputs that I see Landsat making to the global system deal only with crop inventory and monitoring only in the later years. To start with we need very badly to partition the world ecologically. If we are going to sample the world statistically. we have to develop those data on the basis of the productivity potential of the land. Landsat by virtue of its existing capability can contribute to these right away.

I have a schedule on how long it would take us if we made a decision this spring to produce such data which will in fact support an operational LACIE concept.

One of the most important attributes of a satellite is the fact that, it can detect change and agricultural land use change is a very, very important thing.

I know that you felt as keenly as anyone present at the World Food Conference about the importance of the agricultural lands of the . world. I was distressed by the fact that not one word in the technical documentation dealt with the issue of agricultural land use change. The fact that thousands of acres of good agricultural lands are going out of production everyday.

Chairman HUMPHREY. For what reason?

Dr. PARK. Principally because of road construction and urban expansion. But anywhere that one can grow crops, it is often the cheapest land on which to build buildings and roads and that's an unfortunate thing.

Finally, I would argue that there is no data base, no conceivable data base as good as Landsat itself for the global agricultural information system. For its revision, and its verification, the Landsat pictures themselves are the ideal base for the system.

In meteorology, Dr. White has mentioned the importance of that discipline to crop yield, plant growth models and I will not deal with the specifics.

The models are fairly well in hand and it is appropriate to state that we should start now. As the research develops better and better precision, it will certainly be employed. But we have enough proof of concept that we should decide to go ahead now.

Chairman HUMPHREY. That's the Metsat contribution you *are* talking about there ?

Dr. PARE. That's right; the meteorological satellite.

Chairman HUMPHREY. Is there a phase-in of the traditional type of information by the computerization of this data?

Dr. PARK. Yes, sir, and in the case of the crop yield, plant growth models, what has been done is to quantify these observational data in numerical form and fit them into numerical models. The level of sophistication of that technology is quite surprising.

I will only use one of the models in the presentation because it perhaps is the most interesting of all the models. It is the land use management model and represents one more reason for my position that we can in fact make a decision to proceed.

Land use information is derived in this concept from a multidisciplinary team of scientists who use Landsat data to derive an analytical product on land use. And, of course, in the case of agriculture it is a product that either deals with agricultural capability which is the capability of the land to sustain certain types of agriculture or land use suitability which does take into account the political factors that present the scientists with given alternatives with respect to the use of the land and so must be accounted for in the analytical tasks.

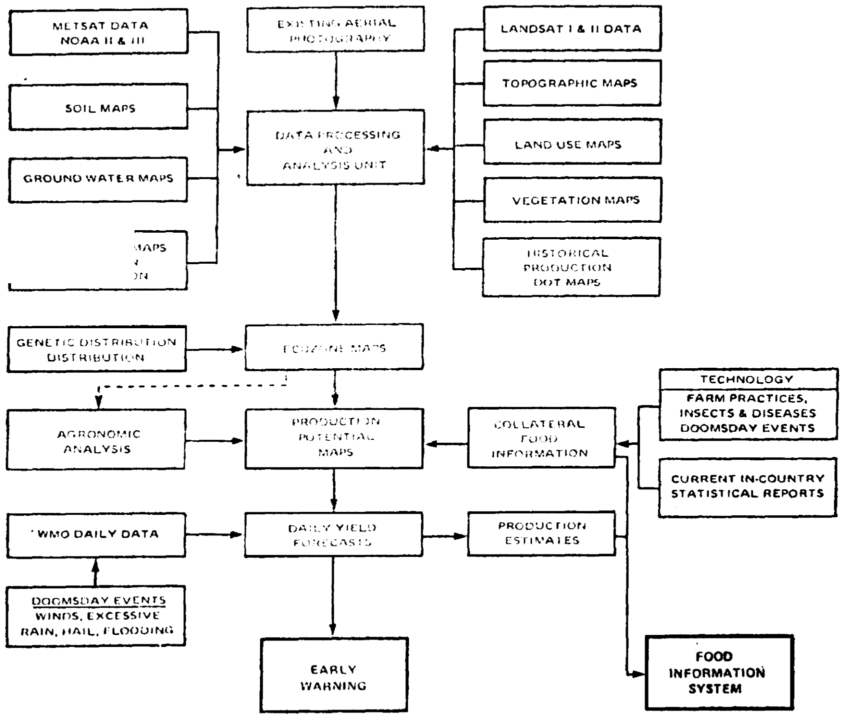
The land use analysis to date, that we, as a corporation have found to be salable in foreign countries is, of course, that which deals with intensive agricultural development, or the improvement of the range of that country, or the actual alternatives that they must consider in the deve!opment of transportation systems.

I mentioned before that land use historically was not an issue in roads. I feel it should have been. One can build a road anywhere. It is no longer necessary to use agricultural land to build roads, since engineering technology is no longer a limiting factor.

When I talk about the rational use of land I do it because the principal interest of these countries and hopefully of our own is the protection of agricultural lands.

This is a chart from the body of my report and I will spend only a moment or two on it.

AGRICULTURAL INFORMATION SYSTEM
FUNCTIONAL ORGANIZATION



I have diagramed how products and information would flow into a system that would produce these products in the order in which I suggested they were able to be produced by Landsat now.

We would use Metsats, existing air photos, and Landsat data combined with all the collateral information as you said yourself, the conventional information that we can get our hands on to produce Ecozone maps. Ecozone is a word which is apolitical in the sense that there are lots of other terms around. If you use them you mean a system that was developed by a certain country.

Landscape mapping is a Soviet term. Land system mapping is an Australian term. And so Ecozone means all of those things so it is equally clear to the Soviets and our own people that we are partitioning the world in terms of its biological productivity.

Now, given an Ecozone map, which is rather a scientific document and given genetic distribution data, an experimental agronomist using a practical approach to the analyses of these data can produce production potential maps of the world.

The real question is: How long does it take to do that if you started now ? And where are we in the R. & D. program so that that product would meet with the current research program in NASA and Agriculture.

Using World Meteorological Organization data daily, and satellite data from the Metsats daily we can produce daily yield forecasts. These are the numerical equations previously referenced in terms of the World Food Conference we are addressing the early warning part of that charge that was given to FAO.

Now, I have-I said that I would propose a timetable of events and here it is. If the decision is made to implement such a program this year, there are a variety of milestones. The soil maps of the world are complete. They are not published by any means, but they are complete. FAO is continuing this work in terms of soils limitations to agriculture.

Chairman HUMPHREY. When you say "soil maps," do you mean just the topography, or are you talking about chemical analysis also?

Dr. PARK. I am talking partially about chemical analysis, but more accuracy the graphic description of soils and a legend system that has been completed for the world. They are fairly small in scale but nonetheless they do exist.

And if you take Landsat data and interpret these soils as they must be interpreted for the models, in my estimation it will be 2 years from this spring before one is finished with the interpretive process for wheat for the world.

If you add to that, rice. it will take another year. And if you add to that, corn, still another year to complete the interpretations of the soils data as required by the models now in use to produce plant growth in yield numbers.

Chairman HUMPHREY. Then the information you obtain would be on productivity, for example ?

Dr. PARK. Yes. sir.

Chairman HUMPHREY. Do you get data on the possibility of disease ?

Dr. PARK. Not yet. That's several years away. But the stress caused by soil moisture is a part of it.

If you started this spring to ask, for example, the Department of Agriculture to develop crop calendars, it would take them a year to do wheat alone.

This calendar of the biological events descriptive of the growth of wheat in my opinion would take at least a year.

Chairman HUMPHREY. There are also critical periods in production. Information on a lack of moisture at one time of the year is more critical than at another time of the year.

Dr. PARK. That's correct.

In the plant growth ancl yield models we literally grow the plant daily and that's specifically why the yield data is a daily event. And as I say. if you want to continue with this work for just the three principal crops, it is not something that can be done just out. of hand and in a hurry.

Chairman HUMPHREY. This is what you are saying is now possible with the current technology?

Dr. PARK. Yes. sir: I am. If you decide to proceed with the Ecozome mapping of the world and you make the maps of just wheat-producing areas of the world to start with, that's a 2-year job. And a further year for rice and one more for corn to do that.

Chairman HUMPHREY. These are all very complicated terms. When you speak of the Ecozone maps, what does that specifically represent?

Dr. PARK. That is the culmination of an interdisciplinary analysis of the land which deals with the drainage, surface materials of the Earth, the geology of the Earth, the soils, and the vegetation. Transportation and cultural features mayor may not be a part of that map but it gives you the information about the natural land system,

These Ecozone maps which are *a* result of this complex; analysis, go together with additional information to produce production potential maps of the world.

Now, production of what? That's the question. As we have said the first effort would be to produce maps for the potential, for wheat growth. To do this would take 2 years for wheat, 3 years for wheat **and** rice, or 4 years for all three.

As for the plant growth models, in my opinion, wheat can be improved, but I believe the models are adequate.

The models for corn are the most advanced but we decided not to start with corn. The fact is that corn is not as important as wheat is in food trade, nor in the food-for-peace program. Wheat is the most important crop in international trade. And even though the models are not as well developed as they are for corn, we all agreed to start with wheat first.

In the Landsat schedule we know that C is scheduled for the fall of 1977 and D is not an approved program. Everyone has mentioned the fact that their programs are hinged on the approval of future missions and that's a key issue for the committee, in my opinion.

Finally, I believe that Earth observation satellites are the only dependable, unbiased source of data, and that Landsat imagery is the only consistent base of data. And one that I don't think can be stressed too hard; and that is that the proposed system benefits by but is not dependent on international cooperation.

That's another key issue; the system as described is one that can be conducted with or without international cooperation. It will generate statistics of acceptable accuracy in either case.

Legislation can certainly strengthen USDA or one could create an independent entity with this single responsibility. Legislation, I believe, should recognize that orbiting resource satellites are the core of the system.

Am-1 finally, legislation should recognize that no present agency of the Government has all of the necessary multidisciplinary skill mix. I would point out that the Department of Agriculture could bring to bear the proper skills but no individual agency of the Department presently has the proper staff.

Thank you very much.

Chairman HUMPHREY. Thank you very much.

[The following paper was requested from Dr. Park by OTA:]

A GLOBAL AGRICULTURAL INFORMATION SYSTEM

This report prepared for the Office of Technology Assessment deals with the application of advanced technology in the fields of remote sensing of the terrestrial biosphere and the atmosphere to provide inputs to a dynamic analytical system which produces quantitative estimates on the current status of agricultural production of selected crops on a global basis.

The report will provide a narrative description of the system including an overview of the design concept. For each element of the system an assessment of the current state-of-the-art will be made. The contribution that each element makes to the system will be covered in sufficient detail to provide both understanding at the system level and to illustrate the tremendous value many of the individual components have in the management of agricultural resources. A brief description of the status of appropriate research and development will follow. Finally, a review of the gaps and/or deficiencies will complete the technical discussion. A section will then follow which will deal with the institutional issues. These will include both national and international problems and suggested solutions where appropriate.

INTRODUCTION

The agricultural objective of the United States and other countries is the alleviation of the world food problem. The major increase in the world's food supply must come from increased production of farm crops. Historically, this has largely been accomplished by bringing additional land under cultivation. More recently increased food production has been met by increasing the yields on the land already under cultivation *in* both the developed and the developing countries.

A major essential for any agricultural management system is the availability of information on agricultural conditions in a timely fashion, Opportunities for increasing and sustaining the productivity of the land and facilitating product flow in agriculture are identified by the availability of accurate, comprehensive, and timely information on productivity, and on the current and potential use of the land. The lack of such information can be a major obstacle to the further economic development of developing countries and a subsequent obstacle to the formulation of important policies in more fully developed regions.

If one considers the broad base of data required to undertake any major review of the agricultural potential of a large country, to say nothing of a continental land mass, it becomes apparent that "on the ground" observations create manpower and logistical problems of overwhelming proportions.

Current earth observing satellites have demonstrated that with the proper technical. scientific, and institutional support, they can be employed in an operational system designed to provide a continuous overview of agricultural production and agricultural land use on a global basis with the inherent capability to forecast production in advance of harvest.

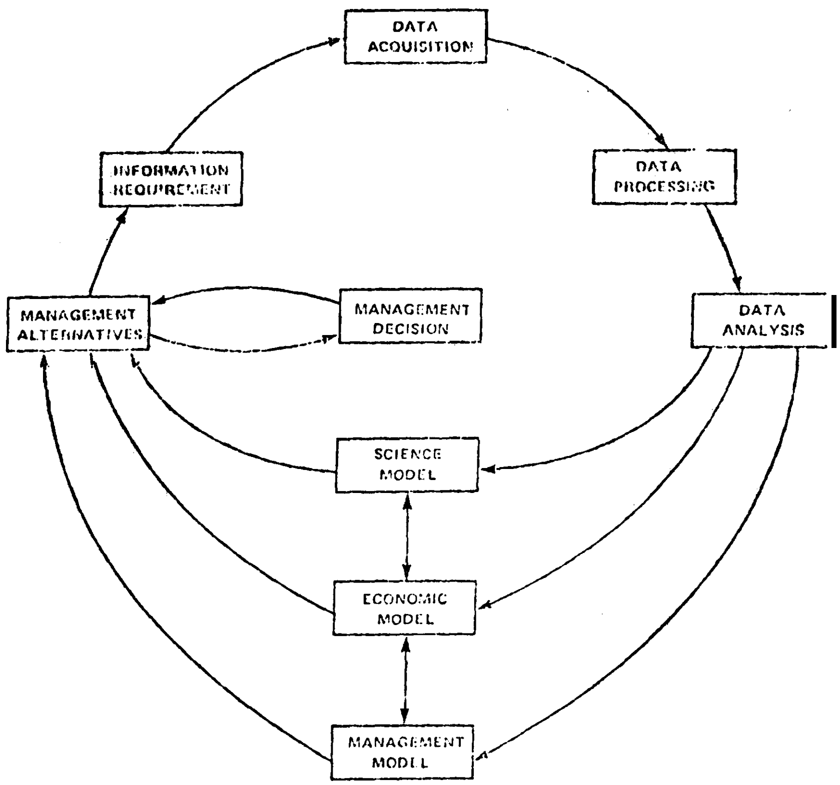


FIGURE 1

1.0 The Technology

Figure 1 is a block diagram of an information system concept which was developed by the writer several years ago and which was designed specifically for use with remote sensing. It is a closed loop model and is centrally oriented in that information flows to the management decision block and requirements for information flow from that block.

In many organizations both in and out of the government sector data is collected simply because it can be acquired. In the development of remote sensing devices there was an intensive effort to focus the research on meeting the requirements of management decision makers in the natural resource fields. This was done because of the high visibility and cost of the acquisition systems, namely satellites and aircraft.

In the DATA PROCESSING block both conventional photo products and more sophisticated and quantitative digital products are prepared and delivered to the analytical group.

In the DATA ANALYSIS block there is a variety of methods available and many of them are suitable for implementation in an operational system. They include conventional photointerpretation with simple light tables, machine assisted interpretation, and finally a fully automated approach using a variety of current computers. The direct recognition of natural resource features based on their shape alone is the exception rather than the rule. In this field the key to the analysis of the feature is frequently color, although the literature more often refers to its “multispectral signature”. In addition the interpretation team is invariably made up of natural resource scientists rather than a team of trained technical level personnel. It is the professional background of the team that makes the interpretation of the data possible.

The MODELS are parallel blocks, but the vertical line between them is meant to imply that there is an interaction between the science, the economic, and the management models. The most popular concept of modeling is that one can reduce all parameters to numerical form for processing in computers. Many natural resource models are numerical in form; many others are not. The term "model" in this document includes both the numerical form and the iterative form where there is a prescribed sequence to the ordering of the data so that cause and effect patterns are produced and conclusions are drawn from the analysis of these patterns. It is in this way that such difficult abstractions as behavior can be modeled. In the section dealing with models, an iterative model on the spread of disease will be shown,

As the figure illustrates, all three of the modeling Mocks may be required to produce information for the MANAGEMENT ALTERNATIVES block. This is as far as the natural resource scientist, in the context of this approach, goes in the production of information for management decisions. In this concept these alternatives ***are*** given to the managers who represent a different entity than the remote sensing resource scientist; and it is appropriate to consider for the purposes of this paper that those decisions are Congressional management decisions. The decision process can result in a course of actions, but that is beyond the scope of this document. However, that process can result in a requirement for additional data for that or future decisions by the management group.

The DATA REQUIREMENTS block constitutes the feed-back loop of the information system, and starts the process over again with the acquisition of data to satisfy that requirement.

If there is a unifying theme to the system concept, it is expressed in the phrase "the convergence of evidence." These words describe both the method and the philosophy of the approach. In merely stating the goal of the technology-to provide a current assessment of the production of selected crops on a global basis--it is necessary to realize that one is trying to monitor, and in some cases predict, the behavior and the interaction between two of our most dynamic environments, the atmosphere and the biosphere. Many scientists consider both ***to be*** intractable; the atmosphere because of its enormity, and the rates at which its processes occur, the biosphere because of its complexity and the interdependence between living and non-living components. The convergence-of-evidence approach is not, however, an admission that the science is inexact. Rather, it is the recognition that it is both complex and dynamic, and that the sources of input data vary in their precision and their reliability. The concept implies that there are several input data sources, as indeed there are, and each is expressed in the following subsections.

1.1 Data Acquisition

In a system where one is going to acquire data on a global basis it is necessary at the outset to consider the issue of national sovereignty and the sensitivity of many countries concerning access to data about their natural resources. The attitude of the majority of countries, including the United States, is that anyone may conduct an inventory, sometimes after the issue of a permit (Australia). The national will is imposed in the exploitation phase. Other countries have very strict laws prohibiting even the inventory (Brazil), while others are principally concerned with their border areas (India). In any case, the use of aircraft for the purpose of an agricultural information system seems for the present to be unacceptable, and because this is so, a concept has been developed which does not use aircraft, even in the United States.

There are two major sources of information, (a) satellites, and (b) collateral data. These satellites include (1) LANDSATS, (2) METSATS, (3) DATASATS. The collateral sources include (1) national governments (Ministries of Agriculture): (2) international bodies (Food and ***Agriculture Organization, and*** World Meteorological Organization of the United Nations) ; and (3) Agribusiness.

1.1.1 LAND8AT Data

Research conducted to date by a number of investigators has established the utility of these data in agricultural information systems. There are various categories of data from LANDSAT.

a. The LANDSAT data is the only source of data.
b. The LANDSAT imagery is the primary source of data.
c. The LANDSAT imagery is supporting data to other satellites and other data sources.

The following list of observable are all essential to an agricultural information system, and each group is structured in order of technical difficulty. Each observable is followed by one of the letters (a), (b), or (c), as indicated above, to denote the category of LANDSAT data.

GROUP I

1. Agriculture vs. non-agriculture: (a).
2. Cereals vs. other crops: (b).
3. Wheat vs. other cereals: (c).

GROUP l-s

1. Soils association maps: (a).
2. Soils reconnaissance maps: (b).
3. Soils survey maps: (c).

GROUP III

1. Vegetation density—biomass—leaf area index: (a).
2. Vegetation vigor: (a), (c), *.
3. Vegetation stress: (a), (c), *.

In addition to these observable, it is necessary to consider the interpretation of these data by skilled agricultural professionals in the appropriate scientific discipline. The following are the outputs of the LANDSAT and LANDSAT-combined sources of data.

1. Ecological Partitioninfl.-Each partition, or geobotanical landscape unit, represents a synthesis of certain key items of knowledge about the area. These variables include the regional distribution of landforms, geology, meteorology and climate, hydrology, and to some extent human activity. The interaction of these phenomena produce a base to which specific living resources such as vegetation and animal life respond, and upon which natural and deposition, work.

The purpose of the analysis is to partition the region or country into meaningful ecological units—meaningful in the sense that for a particular crop or group of crops, for example cereals, the ecological units thus defined will permit samples of yield data taken randomly from the unit to be truly representative of the entire area of the unit. The stratification will greatly improve both the reliability and cost-effectiveness of all kinds of statistics related to productivity, land use, and natural resources. It also becomes a spatial data base. for the systematic organization of available information about both the natural resources and the dependent society, and it represents a basis for organizing and presenting plans for agricultural programs which are founded on the concept that opportunities and constraints to resource development are usually similar in like ecological regions.

Finally, it provides an improved basis for the development of a total resource policy for setting priorities and scheduling program implementation because it gives decision makers at all levels, both administrative and operational, a perspective of the country or region that simplifies what would otherwise be an overwhelming body of complex detail about the resource and the area.

2. Soils Association *Mapping.* —Aside from the basic essential nutrient value of soils, their most significant role in plant growth equations is the way in which they handle water relative to the root systems of plants and the evaporation demands of the atmosphere. For the purposes of the models, particle-size classes are one of the important groupings. Salinity is also considered, as it is an obvious factor in plant/water relationships. LANDSAT data is valuable in the soils task for two reasons: first, the analysis of the LANDSAT data is an agriculture vs. non-agriculture map. That map is used to determine the soils that are important to agriculture. Most soils maps have no companion overlay which indicates to the analyst that he is looking at farmland.

One can infer that certain types of soil are arable, but from the point of view of partitioning and the production of statistical strata the LANDSAT image pro-

*LANDSAT data is most often used to verify the conditions of vegetation vigor and stress, since the state of the vegetation is calculated daily in plant growth models, and the satellite data is used each 9 days or each 18 days, or even less frequently, to confirm that these vegetation condition do in fact exist. On the other hand, the (a) on both vigor and stress indicates that those two conditions can be detected directly on the LANDSAT imagery.

vides the precise boundaries of the arable land and information about surface soil color patterns which are able to be keyed into the existing soil surveys where they are available; and second, inferences can be drawn relative to the important aspects of the soil in the plant growth models, directly from the LANDSAT data where soil surveys are absent.

3. ***Crop Inventory and*** Monitoring.-The repetitive coverage of the satellite permits one to create, in a temporal sense, an inventory of the crops and an assessment of crop conditions throughout the growing season. The reason that it is necessary to conduct a temporal inventory in agriculture is that at certain times in the growing season it is very difficult to separate the species one from another. This is true for remote sensing systems both aircraft and spacecraft and for some crops (cereals) even true for surface observations. Then, at a specific time during the growing season one crop will become very easy to identify, versus all the others; a separate time a second crop, and at still a separate time, a third crop, and so on, so that it requires the repetitive nature of the satellite to build up a catalog of inventory data. It is expected that, even with the improvement in both spatial and spectral resolution afforded by future satellite systems, this particular approach to inventory would be the one that will always have to be followed.

4. ***Agriculture Land Use Change Detection.—The*** ability of LANDSAT to monitor land use change, especially in agriculture, is an exceedingly important tool. As new lands are opened up and as changes occur from dry land farming to irrigation farming, and as different crop types are introduced into the areas, the repetitive coverage of the satellites permits one to assess change, to introduce that change into the data base, and to correct the statistics essentially in real time.

5. ***Global Agricultural Data Base Compilation and Update.—There*** is no single or multiple source of data on agriculture that is comparable in any respect to the LANDSAT image itself; and if it takes five or more years to compile the LANDSAT data base of global agriculture, the task is well worth the effort. The analysis of that data is quite simple from the point of view of the data base, that is, agriculture versus non-agriculture, and the monitoring of the changes of those boundaries. The data is in digital form; it is also in pictorial form. It is able to be stored in computers. Because each picture element is in fact an X, Y coordinate in latitude and longitude, it is easy to update the data base, picture element by picture element if that is necessary. Critics of the LANDSAT program have historically criticized the spatial resolution capability of the satellite system, stating that the 80mm Ground Resolved Distance is far too coarse for meaningful studies. Without debating that issue in this paper, the point should be made that for use as an agricultural data base on a global basis, 80 meters resolution represents far too much data. Proposals have been made to let the complexity of the land itself determine the spatial character of the data base cell. In actual practice, most of these data bases in computer form have a 1 kilometer to 10 kilometer cell size, and when maps are made from this computer base, it is difficult indeed to tell at a glance that you are looking at data in digital form—which is to say that the map is made up of a series of very tiny squares.

If LANDSAT is used to create this data base, and if this data base is to be in a computer for its ready retrieval and storage capability, a decision will have to be made on how and where LANDSAT data will be aggregated to provide a realistic computer matrix cell size.

1.1.2 Present LANDSAT Deficiencies

In a discussion of deficiencies of the LANDSAT system, it is noted that these deficiencies do not prohibit the use of the satellite in the accomplishment of the task described. However, improvements can be made, and undoubtedly will be made, and for that reason they are enumerated.

1. ***Spatial*** resolution.—The present Ground Resolved Distance (GRD) or Instantaneous Field of View (IFOV) is 80 meters. It is convenient to think of the resolution cell as a square patch on the surface of the earth 80 meters long and 80 meters wide. It happens that this is very close to an acre. Because the cell size is that large, it is difficult and in some cases impossible, to see small fields. Some of the important crop growing areas of the world are long, narrow mountain valleys, and it is not possible to say with confidence that one can differentiate anything other than riparian vegetation versus other classes. In some cases even that is difficult. An improvement in the spatial resolution of the satellite would permit a more accurate delineation of fields of small size and more accurate measurement of fields of all sizes. The present measurement cap-

ability of the satellite is a statistical relationship wherein an array of 3 pixels by 3 pixels is accepted as the smallest field that can be measured. This takes into account the probability that a pixel can fall on the edge of a field and thus be made up of partly that field and partly the adjacent field. Thus for area measurement the data are acceptable only when field sizes are that large (approximately 10 acres) (4 hectares) or larger.

2. ***Spectral resolution.***-LANDSAT operates in four bands, the green, red, and two bands in the infrared portions of the spectrum. They are broad bands, being 100 micrometers wide. The multispectral scanner (MSS) was designed to the state-of-the-art, and because the satellite is operating at the altitude and at the speed at which it does, it is essential that these bands be 100 micrometers broad. That permits the detectors in the instrument to record enough energy, i.e., count enough photons to measure the colors reasonably accurately. On the other hand, this broad band color discriminant makes it difficult to separate some plant species from one another. Research conducted over the past decade in aircraft indicates that if these bands are on the order of 50 micrometers wide as opposed to 100, it would be much easier to discriminate the plants, one from another.

3, ***Temporal resolution.-The*** design of LANDSAT permits it to cover the earth in 18 days. The swath width of the image is 185 kilometers, and if one divides the equator into 185-kilometer pieces, one finds that it takes, 18 days to cover the world at the equator. This is a compromise, and resulted from a decision which was made during the design phase. The trade-off involved the question of whether or not to go for global coverage including the equator, or give up complete coverage in order to give more frequent coverage of just the United States. The decision was made to go for a global system.

The success of the satellite in collecting data at the equator and 10 degrees north and south of the equator, where cloud cover has been sufficiently severe to have caused aircraft data collection missions to have failed has in the opinion of the writer justified that decision made in the early days of the program. A large percent of agricultural production grows in that 20-degree equatorial belt around the world. On the other hand, cloud cover statistics suggest that there is a 50% probability that any given area can be covered by clouds, during the growing season: thus the 18-day coverage of the satellite causes gaps in the data resulting in some areas being covered barely adequately during the growing season (two or three times), and others with data that is altogether unsuitable for analysis for agricultural purposes (less than twice). At the present time there are two LANDSAT satellites in orbit; LANDSAT 2 was launched so that coverage is every nine days. The experience to date in the United States where there has been a regular collection of data on that nine-day interval, indicates that this may be the ideal data collection cycle.

4. Format.-Approximately 10% of LANDSAT data is able to be processed as computer-compatible digital tapes. For the analysis of vegetation there is a requirement for the highest possible radiometric accuracy that is available from the satellite data. This means that in the analysis of agricultural data it is necessary to use the data in digital form. The decision made by NASA which resulted in such a small capability has not proven to be supportive of agricultural applications, and recommendations have been made to NASA to increase this capability considerably.

5. ***Throughput.--The*** present minimum time from the acquisition of data in the United States. of the United States, to the delivery of that data to an investigator is about three weeks. The same minimum time, where the data is to be purchased from the EROS Data Center in Sioux Falls rather than be shipped to the investigator by NASA, is on the order of two months. If you ask for the data to be delivered as a computer-compatible digital tape rather than a set of multispectral photographs, that time period can be as long as four months. The maximum allowable time for the analysis of vegetation, and especially in the experimental phase where field investigations will result from observations made in the data, is 48 hours. The desirable time from acquisition to delivery to the analyst is 24 hours. The throughput is perhaps the most serious deficiency in the present LANDSAT program, and denies to the serious investigator the ability to conduct an experiment in anything like real time. It is in every case an after-the-fact analysis of the data. This has had a serious impact on the experiment program in NASA, and has resulted in a lack of serious agricultural investigations except in a very few cases.

6. l)epcndability. Although dependability is both a technical and administrative matter, the technological deficiencies in-dependability deal almost exclusively with the failure of the tape recorders on LANDSAT 1 and 2. This technology has had a history of failure in the NASA program, and one solution that NASA is currently studying is the use of data relay satellites to dispense with the use of tape recorders in future satellites. This is certainly the only sure solution to this technological problem.

The administrative dependability for the issue results from the fact that there is presently no approved operational program, and this too has a bad impact on agricultural investigators since the start-up time and the cost associated with a serious study of the application of the computer-compatible tapes to the analysis of agricultural data is considerable. The result is that even in the U.S. Department of Agriculture there has been a minimal interest *in* the program and a minimum investment on the part of the Department in this technology. The current effort among NASA, NOAA, and USDA in what is referred to as the Large Area Crop Inventory Experiment (L.ACIE) is the first intensive investigation by USDA into the value of this satellite for major agricultural programs.

1.1.3 ***Current LANDSAT Research and Dcvelopment***

In NASA there are two supporting R&D programs in the LANDSAT area. The first is the Supporting Research and Technology program (SIR&T), and the second is the Advanced Applications Flight Experiment program (AAFE). In these programs there is an orderly progression of development from the theoretical or conceptual stage, through laboratory studies, to a field program of measurements, and finally to a test flight program in aircraft at a variety of altitudes, prior to the decision that feasibility has been established and a space flight program is requested for that technology whether it be a sensor or another element of the satellite hardware.

Research and development is proceeding on a number of fronts that are appropriate to future LANDSAT vehicles.

1. Better ***Spatiul*** Resolution.—There is a Multispectral Scanner development program which has as its goal the production of an instrument for space that will have a 40-meter instantaneous field of view (IFOV). It is possible that this research will lead to an instrument that will have even better resolution than that; the number “30 meters” has been cited in the literature.

2. Better ***Spectral*** Resolution.—The advance in solid state detectors for aircraft and satellite implementation leads to the capability of providing a band width for each spectral band of 60 micrometers, so that in this particular respect it is reaching what should be considered to be an operational goal.

3. ***More Spectral Information.***—The multispectral scanner research referred to in 1 and 2 is in addition looking at the possibility of having one or two additional channels of data added to the LANDSAT C capability. LANDSAT C, or the third satellite in the LANDSAT series, will have a five-channel multispectral scanner as opposed to the four-channel scanner on LANDSAT 1 and 2. In LANDSAT C, the thermal infrared band is to be added which' will provide additional information important to agriculture and will include a night time capability for the satellite. The one or two additional channels to be added in the future will be in the reflective infrared; and when added the instrument will cover all of the infrared spectrum available to a satellite platform in which all the infrared channels are in all the atmospheric windows. This seven channel device will be close to meeting the requirements of the operational system in the visible and infrared portions of the E.M spectrum.

4. ***Better Temporal Resolution.***—It has been stated before that there are two vehicles in orbit now providing nine-day coverage. That is very likely to be the operational requirement. There is evidence of course that additional coverage would be desirable, but if that is to be the case, then it would not be -achieved by adding another polar orbiter, but rather to going to a geosynchronous orbit with a Synchronous Earth Observation Satellite (SEOS).”

If the design characteristics of SEOS do not change, it would provide the capability of viewing any place in the United States on a nearly continuous basis with the same spatial resolution as presently available in LANDSAT I and II.

5. Format.-NASA is upgrading its digital processing capability currently and has plans to go to a full digital processing capability for LANDSAT C. If

all of the other organizational and technical issues were solved, the planned launch date of LANDSAT C could be selected as a good goal for the orderly beginning of a global agricultural information system.

6. ***Throughput.-The*** current NASA/U.S. Department of Interior plans include upgrading the capability of both NASA Goddard and the EROS Data Center to provide LANDSAT telemetry from Fairbanks and Goldstone via communications satellite to Goddard. This is in fact a more cost effective solution to the central collection of conterminous United States coverage from the LANDSAT satellite rather than using the mails to send the tapes. The communications satellite interface between NASA and the Department of Interior is a link between Goddard and Sioux Falls.

The EROS Data Center does plan to reformat the satellite telemetry to any user specification. This includes the packing density on the tape, the organization of the data on the tape so that it is compatible with the current analytical software in most computers and at the same time lends itself to the production of imagery directly from the tape.

1.1.4. Research and Development Deficiencies

The principal deficiency in the research and development program is one of goals. The major thrust in the current program is the LACIE effort. The LACIE effort, however, depends on the success of a very difficult technology task, that is the identification and measurement of wheat. In my opinion, a tremendous benefit is technologically possible in the implementation of an agricultural information system without requiring the technology to solve the species identification problems at the outset. It is clearly possible to provide, as has been indicated, a global agricultural data base in pictorial form, and then to proceed with a research program, namely the identification and measurement of the important food crops. The implementation decision should not be based on achieving that particular goal before going operational. There is much that can be done in terms of monitoring the vigor of vegetation, and much that can be done in terms of partitioning the crops into plant communities without having to determine the species composition within the community. The Department of Agriculture and the Food and Agricultural Organization of the United Nations has for years worked with statistical probability and accepted the errors associated with it. In my opinion, the contribution that LANDSAT data can make to the existing statistical methods is sufficiently important and cost effective to justify its employment immediately.

1.2 METSATS

The evaluation of this technology differs from the previous section on LANDSAT in that the satellites that have been used thus far in the agricultural research program have been the operational satellites. They are the NOAA 3 and 4 satellites of the Department of Commerce and the DAPP satellites of the Department of Defense. Both systems provide visible and thermal infrared pictures every twelve hours, thus providing data day and night. However, the DAPP satellite system has two vehicles in orbit thus giving the data each six hours. The analysis of the photography is used in the agricultural research program for precipitation mapping as an input to the agrometeorological models that deal with plant growth and yield. The precipitation analysis is based on the identification of cloud type and cloud brightness and the cloud field analysis is used to draw a map of the spatial distribution of rain. In some cases where ground observing stations are not available to the analyst, he must in addition to drawing a rainfall map, add to that map the amount of precipitation that he estimates is falling from that cloud system, The meteorological data which are applicable to crop forecasting are:

1. Precipitation,
2. Maximum and minimum temperatures,
3. Wind,
4. Relative humidity,
5. Cloud cover.

These data are used to develop transformations that relate to plant growth and yield, these parameter are:

1. net radiation,
2. potential evapotranspiration (ETP),
3. precipitation,
4. degree days,
5. day length.

Evapotranspiration (ETP) and precipitation are used together with soil and vegetation data to calculate soil moisture. The soil moisture data can be used to assess moisture stress in the plant. Degree days assist in determining the phonological age of the plant. The two together (moisture stress and age) permit the assessment of the significance of the moisture stress in terms of yield.

Net radiation (RNET) is the net energy gained by the ground through the processes of insulation find terrestrial radiation losses to space. RNET is a measure of how energy is available for photosynthesis for heating the ground and most importantly, for evaporation. RNET shows a pronounced annual cycle with the highest values in the summer when the days are longest and the sun is highest above the horizon, and lowest values in the winter when the sun is lowest. Cloudiness also has an effect on RNET since it depletes both the incoming solar radiation and the outgoing terrestrial radiation. In addition, there are in the calculations coefficients which account for atmospheric transmission, latitude, longitude and time of day. An important parameter is cloud type which affects that portion of the long wave radiation that is lost to space. Frequently the climatological records do not contain the information necessary to determine the effects of clouds not only on the long wave terrestrial radiation, but also the incoming solar radiation. A method has been developed which uses satellite cloud information and is considered a major innovation in the models.

The form of the precipitation equation is:

$$P_{sat}=k_0+k_1Cb+k_2Cc+k_3Ns+k_4St+k_5B1+k_6B2$$

where ***P., t is*** the satellite rainfall estimate; Cb, Cc, Ns, St are the percentages of cumulonimbus, cumuluscongestus, nimbostratus, and stratus cloud types measured from the visible satellite images; B1 and B2 are percentages of brightest and bright cloud cover occurrences in the infrared images, k. , . . . k6, are regression constants. For the agromet cells that do not have surface meteorological observing station precipitation reports, the final estimate of precipitation is calculated by a combination of the satellite estimate P_{sat} and the ground estimate Pg. The ground estimate is obtained from the precipitation measured at the surface synoptic station assigned to that cell. The "cell" refers to our data base which is a map of the crop producing areas of the world divided into 50 or 25 or 12.5 nautical miles squares, depending on the precision desired in the production statistics.

1,2.1 Metsat ***Deficiencies***

In considering deficiencies in the Metsat data, it is important to note that we are dealing with operational systems designed to acquire operational data to meet the needs of the organizational entities that are responsible for their design and their employment. So to he critical of the deficiencies of that system when used for an entirely different purpose from which it was designed is somewhat unfair. Nonetheless, the use of the data for agricultural information purposes would be better served if there was a storage and retrieval system which would store and from which could be retrieved full resolution data and similarly if the data was in digital form, that would he preferable.

The problem is not that the data is not currently available in digital form and at full resolution in terms of its use in day to day modeling. .411 of that is possible providing an approved interface is established between NOAA, NESS in Suitland and the user. However, an important element in the preparation of the' agricultural information data is the historical analysis of climate and the value that can be derived in terms of establishing agricultural production trends in the context of climatological trends. It is exceedingly difficult to perform a rigorous analysis of the climatology of an area ***on*** the basis of the records, if any, that are kept currently by many national governments. .4 much more useful study can be made by using the satellite data in conjunction with whatever national data is available.

1.2.2 Metsat Research and Developement

In the field of the development of new meteorological satellites. the ***advent*** of global synchronous meteorological satellites similar to the United States Geosynchronous Orbiting Evironmental Satellite (GOES) will provide synoptic data over the whole world of agriculture with the possibility of monitoring cloud cover from pictures sent each 20 minutes, 24 *hours* **a day** from such satellites. The analysis of the contribution of the synchronous satellite to the crop production models is currently under study. The polar orbiting satellites, DAPP, and the NOAA 8 and 4 vehicles have provided the information that has been principally used in the work that has been done to date. The next generation of operational weather satellites, the TIROS series, will provide both better spatial resolution but equally important, the data will be fully digital and calibrated so that the utility to precipitation mapping and radiation mapping will be enhanced.

In the field of instrument development there is in the NIMBUS program a microwave sensor development program. This affords direct information on precipitation from clouds, however for the present these analyses are only successful over the oceans and not over the land. Some success has been noted where the topographic influence on the microwave return is minimal. On gently rolling plains the data are more interpretable than where the topography is rough. The most important single microwave measurement that can be made which will contribute to an agricultural information system is that of soil moisture.

There is, in the supporting research and technology program in NASA, a vigorous effort underway at this time to develop a microwave system that will provide direct soil moisture measurements at a variety of depths. At this point and time, it seems feasible to expect that we will be able to make soil moisture measurements to depths of about 5 centimeters. Additional research will be necessary to go below this depth but 5 cms is a very important achievement. The current soil moisture models do project soil moisture estimates to various depths which in theory match the root zones of plants at various ages. On the other hand, the rooting systems of plants are not well known in all types of soils and under all kinds of conditions at various ages. If the research is successful in producing an instrument which can measure soil moisture accurately and directly to a depth of 5 centimeters, we will have a measurement that is more accurate than much of the data in the rest of the model and would certainly support the crop growth and yield models in an early operational agricultural information system.

1.3 DATASATS

This particular technology although not really an R&D activity on the part of the Federal Government does have elements in it that have significance to an operational agricultural information system and which essentially have not been tested. There are three principal systems involved that can be grouped under the term DATASATS. The most common, in terms of awareness by the general public, are the COMSAT/INTELSAT Communication Satellites which are in use and have been in use for a number of years. A more current and important from the point of the view of United States agriculture system is the DOMSAT series which provide the United States with a domestic communication system with sufficiently wide bandwidth to transmit television pictures in color. The principal use, aside from watching international events such as the Olympics on a nearly worldwide basis, for the INTELSAT/COMSAT type of communication system, has been in international telephone traffic largely replacing the transatlantic cables. The status of communication satellites is that the administration has determined that they are operational and NASA is no longer conducting research and development on these particular systems. There, is, however, a development activity which will produce a communication system that is important for the future of the information system we are discussing. This is a wideband satellite to satellite telemetry system. For example, LANDSAT imagery acquired over Europe could be transmitted directly via communication satellites of this type to any receiving station in the United States that was equipped to handle that particular communication link.

The most significant point in discussing the data relay satellite is that a country, for example Germany, could build a ground receiving station for LANDSAT. The satellite could be transmitting pictures to the station of the entire area under the range of that ground receiving station (approximately a 3000 km radius) and at the same time be transmitting that very same data back to the United States or to an international station which might be given the responsibility and authority for the operation of the global agricultural information system. It does away with the single most perplexing technological problem in current satellites, that being the tape recorders with their attendant failures. It should be noted that applying the same scenario to the INTELSAT network, that German ground receiving station could receive the satellite telemetry from a LANDSAT satellite and via a colocated INTELSAT station retransmit that data anywhere in the world that has an INTELSAT receiving station. This scenario however requires cooperation on the part of all ground receiving stations in the world so that the global data is available to either the United States or to an international body that will conduct the agricultural information system.

Almost unknown to the general public is the capability of the earth observing satellites such as LANDSAT and METSATS including GOES to provide a telemetry channel for the transmission of data. This particular capability is not conventional in the sense that people use it for a voice grade lines, rather ground base instruments such as stream gauges, rain gauges, thermometers, thermistors, micrometeorological stations including anemometers and barometers, wet bulb thermometers, etc., have been instrumented in a way that permits the data to be recorded in electrical form, digitized and multiplexed and then sent from that particular platform location to LANDSAT or GOES and then from the vehicle, which merely acts as a repeater, the data is retransmitted back to a central location in the United States. The Suitland facility of NOAA is the receiver of the GOES data and in the case of LANDSAT the Goddard station is the receiver. Currently other stations in the world including some of the unified S-band NasCom stations are able to read out the LANDSAT system which is referred to as the Data Collection System (DCS). The bandwidth is relatively modest, about the same order as the housekeeping telemetry. The information that is transmitted over this net is exceedingly important from the point of view of its compatibility with a potential operational agricultural system. It is possible for example to equip all of the synoptic weather stations of the world with the kind of telemetry that is now available to the LANDSAT satellites, which incidentally is itself compatible with the telemetry systems on GOES. A single platform can either transmit to LANDSAT or to GOES. It is possible to take all these measurements from everywhere in the agricultural world using LA4NDSAT and retransmit these data to a sufficient number of ground stations so that global acquisition of surface meteorological data is possible. It is a rather unwieldy system at present, simply because so many ground stations are involved and so much repeating of the data would have to occur to assemble it in one place. In the near future when the European, Japanese and Russian versions of the GOES satellite are placed into their respective orbits, we will have a global capability with just four satellites and four centers. However, it will still be necessary to retransmit this data to a central location for processing,

One conceivable organizational entity which might evolve is that regional agricultural data processing centers would be located in association with the U. S., European, Japanese and Soviet satellites. It is not necessary that the station be located in any one of those sponsoring nations but merely within line of sight of the satellite. In the case of geosynchronous satellite this is a very large footprint indeed.

In summary then, there has been a good deal of work particularly in the LANDSAT experiments on the transmission of data that is important in support of agricultural information system models. None of these data have been transmitted in anything like an operational mode, but the experiments have been successful. In conjunction with that is the current availability of INTELSAT facilities which have an extensive worldwide capability. In addition a global geosynchronous capability will exist sometime between now and 1980. This will afford a complete capability for the global acquisition and transmission of data that is supportive and important to the agricultural information system.

In my opinion, no additional technological development is required. The most important single event will occur when data relay satellites are launched and placed in orbit so that the imaging satellites can dispense with tape recorders. It will be possible to go from the surface to satellites to satellite to a single location on the ground where a global agricultural information system can operate.

1.4 Surface 0bservations and Measurements

There are a number of collateral data sources that are important to the operation of a system which is interested in agricultural production on a realtime basis. These are somewhat non-numerical in nature in that they deal with the collection of data from current agricultural research reports, the publication of agricultural statistics by national governments, the summation and publication of similar statistics by international organizations like the Food and Agriculture Organization of the United Nations and finally the contributions that can come in from agribusiness if they choose to cooperate in the operation of such a system.

'The problem that has been cited by both the Department of Agriculture and by FAO is that with the exception of a very, very small number of countries, the ' data are either inaccurate or incomplete or not received in time. At least two out of the three problem areas are associated with almost all of the countries in the world. Timeliness is an issue everywhere and in fact timeliness is one of the strong motivating factors behind the current LACIE research and development program of the NASA/NOAA/USDA team. We need more timely data and we need it almost on a continuum throughout the growing season in order to have the information necessary to make policy decisions. International statistical organizations are really victims of national governments in that all they can really do is publish whatever is provided for them by the national governments.

If no information is provided by any particular national government, very rudimentary estimates are made by professionals on the staff of that organization. Agribusiness finds the current accuracy and availability of statistical data on agriculture so wanting that they have had to create a staff of employ- in the important countries where they do business; there to provide them with their own estimates of production so that they can manage their own transportation, warehousing, sales, etc. In the past three years, our dealings with the Soviet Union have forced us to look at the accuracy, timeliness and completeness of Agricultural statistics with the same degree of urgency and need that has always been the case in the industrial side of agriculture.

2.0 ***Data Processing***

Data processing is set out separately because of the impact that this particular technology has, not only on cost and schedule, but also because of its impact on the user, It covers that part of the technology that deals with manipulation of the satellite data in preparation for delivery of a product to the user whether that be a government agency like the Department of Agriculture or an individual experiment investigator. The two principal products out of the processing line are pictures and computer compatible tapes. The scheme that has been developed by NASA for preparing the data, that is converting the satellite telemetry from a high density digital telemetry tape to a picture or to a computer compatible tape. involves a number of steps. In the case of the picture, the digital data goes through a computer where it is corrected for geometry distortions, referred to as system corrections, in which the effect of the rotation of the earth under the satellite is corrected. There is an additional correction possible using the attitude sensor on the satellite. The attitude of the satellite relative to true vertical is calculated and those corrections can also be made in the scene. In addition to geometry there Is a radiometric correction made. This is necessitated by the fact that the detectors in the sensor do degrade with time. One or more can fail, thus it is necessary to check the calibration frequently and make the radiometric corrections as required.

The computer compatible tape on the other hand is neither geometrically nor radiometrically corrected. The data is merely reformatted from high density digital tape (20,000 bits per inch) to computer compatible tape (conventionally 800 bits per inch.) It is the responsibility of the investigator to make the geometric and radiometric corrections necessary in the tape.

2.1 Deficiencies

The principal complaint on the part of the users of LANDSAT-1 data was the selected scale of the imagery. The high density digital tape was used to drive an instrument called an electron beam recorder which wrote an image line by line at a scale of approximately 1:3,000,000. That particular scale is so small that essentially none of the users of the data had experience at working at that scale. The ground data processing facility also produced an image at a scale of 1 :1,000,000 which was derived from a photographic enlargement of the original 70 mm scene written on 230 mm (9 inch) format, This product was acceptable for a few applications, principally studies that involved regional geology or studies that involved the mosaicking of a large number of LANDSAT frames. Where very large regional geologic structures were the subject of investigation, then the scale of 1:1,000,000 and the mosaicking of that format proved to be a very appropriate tool. However in almost no other case was the 1 :1,000,000 scale useful, The original 70 mm material was merely treated as a file copy for use in the photographic laboratory and either NASA produced the imagery at 1:1,000.000 or the user did with his own enlarger. However, where the user required larger scales, including scales of 1:250,000 or greater, the investigators that were most successful were those who made the 1:250,000 scale enlargements from the NASA product which reached them at a scale of 1:1,000,000. This is a simple 4X enlargement and does not require an expensive ($5,000) enlarger lens. The 4X enlargement was made from nine inch film which is standard aerial photographic format. There were fortunately many users that were able to bring this rather simple technology to bear on the problem of processing the data into a format useful for analysis.

The other problem in the pictures proved to be that of contrast. The photographic rendition in every case contained 100% of the grey scale information that was available on the satellite telemetry tape. On the other hand, that information was frequently biased at one end of the grey scale spectrum or the other and the material sent to the field was practically unusable. A good example is to consider the reflectance that one would expect to get from the desert during mid-summer where sun angle is highest. The return is very, very bright. This produces a very, very dark negative and indeed the "dark negatives" from the NASA ground data handling system created a very difficult problem for many investigators during the first summer of the data gathering mission of LANDSAT-1.

In the case of the computer compatible tapes, the principal deficiency is that of format. Prior to a recent decision by NASA to change the format, a LANDSAT *scene* covering an area *on* the surface of 185 X 185 kilometers was sent *on* four tapes. The format was a 25 mile strip of band 1, 25 mile strip of band 2, a 25 mile strip of band 3, and a 25 mile strip of band 4 each on a separate tape. The 25 mile strips put together made a 100 nautical miles which is the equivalent of 185 kilometers. That kind of format is useful for a certain analytical procedure and perhaps those people who are interested in a small portion of the scene who defend the decision to go with 25 mile strips, but Murphy's law would almost guarantee that the area of interest would be on the extreme edge of two tapes rather than being in the center of one 25 mile swath. Tape density was principally 800 bits per inch whereas 1600 bits per inch is a more cost effective format. The current decision of NASA will change to 1600 bits per inch. The decision also affects format and the combination of changing to 1600 bits per inch and changing the format will permit NASA to record ***all of a*** LANDSAT scene on ***one*** computer compatible tape.

2.2 ***Rcscarch and Development***

There are some important R&D tasks underway that have exceedingly useful implications for the subject of an operational agricultural system. In the first **place,** from the point of view of pictures, NASA is planning to go from the electron beam recorder to the laser beam recorder. That will mean that the recording device can have the capability of accepting data from the next generation of multispectral scanners. These have 30 to 40 meter spatial resolution and seven channels of data as opposed to LANDSAT with 80 **meter** resolution with just four channels. In addition the device can be implemented to record in color as opposed to black and white which is all that is presently available.

However, the most important attribute of the Laser Beam Recorder is that it has been implemented to write on the large format, that is the 1:1,000,000 scale format. In analysis done of the information content of LANDSAT 1 indicates that if the original image is written at a scale of 1:1,000,000, and if further enlargement is done photographically with reasonably high quality photographic leases, with careful processing of the data, that all of the resolution of LANDSAT will be equally available to the photographic interpreter as is now only available to the analyst who uses computers to aid him in the presentation of the data. This means that the principal Complaint of the users, that being the very small scale of the image, will be solved in the very near future. In the digital field, the research and development is equally encouraging. NASA is acquiring a facility which will employ the very latest hardware and software as sort of a model for the users and available to the users for the interpretation of data. Although this facility is in fact an analytical facility, there will be an opportunity to employ the best and latest software and hardware in the processing stage as well as the analytic stage. Both NASA and the users can take advantage of the facility.

2..? Issues

The principal issue facing the community of LANDSAT users between now and the time when an operational decision will be made is the one of the definition of the role of the satellite. Is it proper to perform quasi-operational or even operational tasks with a so-called experimental vehicle? For many of us, the experiment phase of the program was finished when NASA demonstrated that LANDSAT 1 worked successfully in orbit. The satellite provided color-infrared imagery of the earth. The supporting research and technology program had for the previous five years demonstrated the value of color-infrared imagery of the earth, and the experiments performed during that phase concerned themselves principally with operational activities of the Federal Government in the three departments that were the principal interface with NASA, the Department of the Interior, the Department of Agriculture, and the Department of Commerce. Thus the issue of format and through-put is a very real issue and always has been. It may on the one hand be correct to avoid spending the money necessary to achieve what amounts to an operational interface between NASA and the users during an "experimental" program. The impact of that decision, however, was very negative on a whole body of investigators whose application, by the very nature of it, required a very fast turnaround time between acquisition and delivery of data in an immediately useable form.

A second question is related to how far NASA should go in providing rather sophisticated processing of the data for the group of users that are the general interface in this program. For example, any data that is going to be delivered to users in pictorial form can go through a number of preprocessing steps. Each of these has an impact on the quality of the data, and each of them is characterized by the fact that the more sophisticated the processing step the less sophisticated the user needs to be in the analysis phase. It is very nearly axiomatic that there is an inverse relationship between the skill of the user and the degree of complexity required on the part of NASA in the processing stage.

A few examples can illustrate the problem. In addition to the geometry correction for the earth's rotation which is called a deskew algorithm, and the system correction of the radiometry, the image could very well be squared so that it approaches a map-like quality before that data is delivered to the user. He then can fit this image to a map of some specified scale without having to go through any further steps.

Secondly, there is the issue of black negatives discussed previously. The images can be equalized so that there is a balance between the two ends of the gray scale spectrum and instead of having a black negative the investigator gets a negative with very high contrast. In cases where the gray scale content of the scene is less than the dynamic range of the film, the scene can be stretched so that even very subtle shades of gray are discernible to the photographic interpreter.

Third, certain image enhancement algorithms can be performed on the data. One such algorithm enhances edges and is very useful from the point of view of the agricultural scientist because linear features, such as field boundaries, roads, etc., are enhanced, and this increases the interpretability of the data considerably.

Fourth, it is possible to enlarge the data in the computer so that the delivered image can be played on an image recorder having been enlarged digitally. There is no photographic step between the acquisition of the data on high-density digital telemetry tape, and delivery to the user of a scene as large as 1:100,000. The resulting picture made from such a tape is extremely useable to any investigator, since there is no loss in image quality when the processing is done in the computer.

If desirable and necessary, a team could be made up of agriculturalists, hydrologists, geologists, soil scientists, and the like, each of whom would specify from among the library of programs what the final format should be for each scene that is going to be analyzed by one of his fellow disciplinarians. A processing recipe book could be prepared for pictorial presentations of the LANDSAT data for each of the resource areas.

Finally is the issue of budgets. Perhaps the most serious issue with respect to responsibilities and where those responsibilities cease, is related to the budget. If for example the Department of Interior budget is the source of let's say analytical hardware for the program and that budget is cut, then the entire earth resources survey program suffers. and not just the Department of Interior program. Similarly, if the Department of Agriculture budget is cut. it affects not just the Department of Agriculture, but practically all vegetation-related studies. NASA has been fortunate in that the designation of the program as "experimental" has had the advantage of permitting NASA a very wide flexibility in terms of devoting resources to the further development of applications which might on the face of it be purely the province of the Department of

Agriculture, or purely the province of the Department of the Interior. For a number of years now there has been a mechanism for the previous review and submission of ‘a joint budget. The Administration formed a committee which coordinated the entire R&D program; they follow the conduct of the research and development; they approve program content and they approve budgets. The Office of Management and Budget has cooperated to the extent that the agency examiners have worked together on the program as an entity. The General Accounting Office has in fact stated that the Earth Resources Survey Program was a model of how an inter-agency research and development program should be conducted, The principal problem related to the project has resided in the fate of those budgets in the Congress. It is not the purpose of this paper to discuss the legislative history of this program, but it is possible for the Office of Technology Assessment to review the inter-agency documentation including the budget material since the inception of the inter-agency committee responsible for the program, and then to compare that with the fate of the budget, department by department, over the past several years. The impact of these budgetary problems has been diffcult and it is in fact a credit to the program managers that the program enjoys the maturity that it does today.

3.0 *Data Analysis*

This section can be thought of as **being** in three parts. First there are the analytical methods, using only man. These are classical photointerpretation techniques, somewhat modified because of the synoptic view of the data. The conventional aerial photograph is usually acquired at a contact scale of 1:200,000, although there are lots of newer materials at scales of 1:100,000 and smaller from high altitude aircraft. The scale of the original LANDSAT material provided by NASA is as stated before, 1:3 million, and much of it provided at a scale of 1:1 million. ***One*** of the most important findings of the extensive experiments that were done with LANDSAT concerning the productivity of the photointerpreters to get a job done is that for agricultural analysis. It was not unusual to find that the interpretation was able to be done 20 times faster on the LANDSAT imagery. This is not due to any other intrinsic value of LANDSAT beyond the fact that it provides a single image on which to work as opposed to the hundreds of images which would be required to make up a scene as large as the LANDSAT scenes strictly from aerial photography at almost any acquisition scale. For example, at a contact scale of 1:20,000, it takes more than 6,500 conventional air photos to make a single LANDSAT scene.

The second analysis method is completely automatic. There are a number of computers that have had LANDSAT analysis performed on them. Among them are IBM, UNIVAC, CDC, HONEYWELL, Digital Equipment Company, Hewlett-Packard, XEROX, and finally one of the largest computers the United States government has ever built, ILLIAC--IV. This machine is in the custody of NASA, and is at the Ames Research Center in Mountain View, California where it is shared with the Lawrence Radiation Laboratory as a national facility. Some rather interesting capability studies have been done concerning the ability of ILLIAC-IV to provide the operational support for an operational LANDSAT system. Because ILLIAC-IV has a storage capacity of 1 trillion bits, it is possible to store the United States in multispectral form, at full resolution, in the machine, and to perform analytical tasks on the country as a whole. Thus a national data base would be able to be updated, used, analyzed, measured, etc. in essentially real time.

The third and last method is the combination of the first two: a man/machine mode, The concept behind this technique is that one should really let man do what man does best, and let the machines do what they do best. After some 10 years of working this problem, it is possible now to state what those parameters are. Man recognizes shape and integrates a scene, coming to a spatial conclusion about that scene almost infinitely faster than a computer. On the other hand, man is a very ***poor*** judge of color. Man% eyes are logarithmic sensors, which means that it takes a 10% change in reflectance before man notices that color has changed. Consider the accuracy of the radiometer that is on the very first LANDSAT vehicle. The sensitivity of the multispectral scanner is 3%. Expressed another way, the MSS is 3 times better ‘than man's eyes and with the potential to grow much more sensitive than that. The machine does the color analysis, and separates things on the basis of color, man does the spatial analysis and separates things on the basis of shape.

In terms of available equipment some of the universities have participated in the development of this man/machine interface concept. A principal university charged with this responsibility from the point, of view of hardware development was the University of Michigan, specifically the Environmental Research Institute of Michigan, formerly Willow Run Laboratories of the University, of Michigan. There has been industry support; the Bendix Corporation and the, General Electric Corporation have produced off-the-shelf analytical man/machine hardware devices. These are starting to be used. There have been sales, in this country for sales in Europe, and they are extremely useful machines, most. of them built on. the same principle, slightly different in terms of complexity and what each machine can do. Nonetheless, both are candidates for any operational decision for the analysis of LANDSAT data in an agricultural information system.

3.1 Data Analysis Deficiencies

The deficiencies in data analysis stem largely from the small' support that has been able to be afforded in the program. LANDSAT is a digital data gathering machine. It follows that most of the serious investigations should have been at least man/machine-oriented, or even totally machine-oriented. However, a review of the some 300 experiments on LANDSAT indicates that relatively few were supported by proper digital equipment. The supporting research and technology program, however, has created a few university centers of excellence. Purdue University and the University of Michigan are two of those, and most of the work that has been done in the digital data analysis has been done by those two organizations, The work that has been done gives us confidence that given the proper technical approach to the problem it is feasible to set up a system which employs both men and machines to perform an agricultural task on a global basis.

3.2 *Research and Development*

The principal R&D in the field of data analysis today is in the further exploitation of the man/machine concept and as a refinement, a serious look at the issue of analog versus digital analytical techniques. Some investigators feel that the state of research and development in the digital computer field is so dynamic that it is not wise to spend a great deal of money on analog techniques in the Earth Resources Survey field. In principle, the analog device is exceedingly fast, but it is fairly inflexible, and it is somewhat destructive of data. This is exemplified by the fact that playing an analog tape over and over again does indeed destroy some of the voltage records on that tape; whereas the repetitive playing of a digital tape does not destroy the numbers, although there is an error rate associated with all digital tapes and tape recorders. On the other hand, there is the issue of a tremendous data volume generated by a multispectral instrument *in* space, especially *on* the global scale, and a desire on almost everyone's part to perform the analytical function as fast as possible. Aside from the magnitude of the data, there is the realization that the satellite is going to repeat its orbit in 18 days and that is a very short time indeed, to complete the analysis of that data. This is further complicated by the fact that if there are two satellites then we have twice as much work to do. Therefore, there is a serious look at what is known as a hybrid device where certain tasks are done in analog fashion and certain done in digital fashion. The other school of thought holds that digital devices are becoming so fast and so cheap that one should not invest in hardwired analog devices.

The Italian ground station for LANDSAT has two programmable digital microprocessors which can reformat the satellite telemetry in real time and can present the data in a format that permits the ground station to either go to a photographic line for reproduction or go right into their analytical line for analysis. It is not necessary there to create computer-compatible tapes although the station is designed to do that for other users. This digital device, the programmable microprocessor, is sufficiently fast that the high-density digital tape is subjected to a series of complicated arithmetic steps in real time.

These devices permitted the Zaire ground station design to employ a two-shift mode of operation wherein the first shift uses the system to produce photography and computer-compatible tapes for the customers within the footprint of that ground station, and the second shift uses the identical equipment to produce analytical type products including the analysis of data in digital form, and the production of analyzed photographs in which objects in the scene can be color coded. This concept is most cost-effective for a country like Zaire or any similar regional ground station.

These new concepts are solely the result of this new very fast, very flexible, programmable digital device.

3.3 ***Issues***

The principal issue in data analysis is organizational, and this is related to cost. It is possible, for example, to design a central data processing facility; if you will, another Sioux Falls EROS Data Center, this one, however, being de. signed specifically for the analysis of agricultural data. It is equally possible to design a central processing station with regional analytical centers. These analytical centers can be of two types. One type could be where the orientation is geographic, and the center would be located in the geographic area for which it was responsible. The second orientation could be subject matter, wherein all of the crops would be clone at one regional center, all of the range and forestry studies done at another center, and all of the maps made in still a third center. It is true that cost savings can be accrued by centralization, especially with systems like LANDSAT and METSAT. One has to determine whether or not the input to a regional analysis center is in fact repetitious for the data processing center or whether each is different in nature. Put another way, do the specialized thematic analyses require the very same data regardless of their task? If they do then that argues well for centralized data processing ***and*** analysis centers where you have one machine doing processing and feeding a number of stations wherein the special studies are conducted.

The analysis work done to date tends to further support the centralized facility. The activity at Purdue University is typical of the success of putting together a complex, multi-disciplinary group of people who came from a variety of backgrounds; from mathematics, statistics, physics, computer sciences, agronomy, soils, forestry, range, meteorology, hydrology, etc.

These scientists came together under one roof. The organizational entity was not merely a paper chart, but a real physical plant where they were separated from their otherwise parent institutions and where they learned ***over a period*** of time to work together. The synergism that resulted from that decision was real and mensurable. The programs achieved in a very short time by the Laboratory for the Application of Remote Sensing at Purdue was sufficiently important that NASA recognized Purdue as a center of excellence in the field of digital data processing.

If the Congress undertakes, or if the Congress directs the Department of Agriculture to undertake, this global food information system, I recommend strongly that a centralized data processing and analysis facility be created for the staff that will operate it. The author undertook to do an analysis of a similar situation for the Food and Agricultural Organization of the United Nations. It was recommended that the data processing and analysis group become a self-contained, separate entity in FAO. In an operational unit, such as the one designed, that cuts across organization lines, it is useful and certainly desirable for the unit to have autonomy for at least two reasons: First, the contributing parent organizations can and will make demands on the time of their personnel assigned to such a job; and secondly, the value of some of the by-products, such as the ecozone maps, may create a demand for that product which will interfere with the larger task which is the creation of an agricultural information system. A functional organization chart of the data processing and analysis unit is included as Figure 2.

AGRICULTURAL INFORMATION SYSTEM
FUNCTIONAL ORGANIZATION

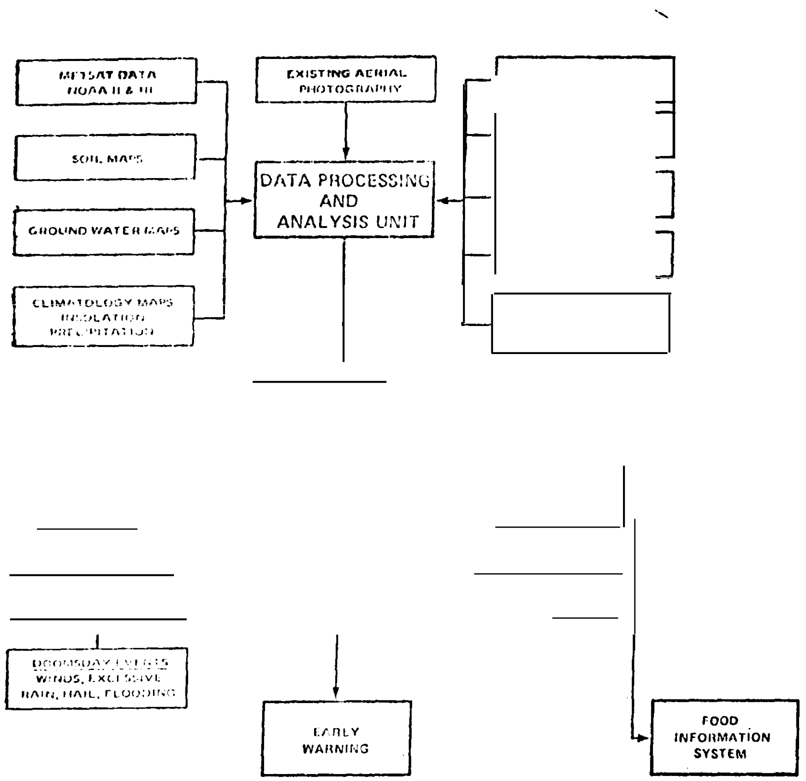


FIGURE 2

4.0 Models

There are three types of models currently employed in the development phases of the earth resources survey program that are applicable to agricultural information. These are 1) science models, 2) management models, and 3) economic models. It is correct to consider that 1 and 2 together constitute the basis of an economic model, except that the science and management models need not have the economic multipliers. For the purpose of this paper, two science models related to agriculture and one management model related to agriculture will be used.

4.1 Crop Production

The classical approach to the statistical reporting of crop production involves the design of a sampling system which considers the total population of the crop or crops involved, and draws statistically valid samples on a geographic basis with a frequency that is appropriate to the phenology of these crops. In countries where the agricultural statistical services are considered to be well conceived and operated, the selection of the location of the sample areas is done on a random basis within an ecologically defined "crop reporting district," as is the case in the United States. However, the classical statistical approach does not make any use of agro-meteorological data except as the sample data manifests the plant environment into actions expressed as changes in estimates of yield from one sample period to the next. The basic limitation of this statistical approach is in the inherent impossibility of timely predictions, particularly early in the growing season.

The sample only provides estimates that reflect what has occurred in the plant from planting to sample time. If the plant moisture and heat conditions remain optimum until harvest, good estimates are possible. It is important to point out that the "excellent" accuracies attributed to currently accepted methods are all based on sample data collected during the period just prior to harvest. In the case of the agro-meteorological approach, the primary advantage is timeliness. The diagnosis of the plant environment interaction provides daily estimates of yield changes. The application of reasonable skills in short-range forecasts (seasonal or yearly) permit the projection of the evaluated data on daily yield changes to the end of the growing season. One's confidence in the projection grows each day, and one can project that confidence with the same rational expectancy without mounting the vast manpower that would be required for daily ground sampling. The agro-meteorological approach to crop forecasting has been used in limited regions of the world for many years. In recent years the Canadians have applied agro-meteorological approaches to wheat forecasting with excellent results. These results reflect the fact that given accurate meteorological data and plant stress, wheat is well enough understood physiologically to permit yield predictions for large areas in spite of the within-field and field-to-field yield variability that is inherent in ground sampling. A block diagram of the production ***model is*** Figure 3. The model is based on the simple equation Yield X Hectares= Production. The yield modifiers, including water, soils, thermal units, and photoperiod, are all numerical inputs from the LANDSAT and METSAT data in combination with data from the World Meteorological Organization synoptic weather stations.

Hectares are modified by water and physiography, both derivable from LANDSAT data. All of the other modifiers, both to Yield and to Hectares at this point in time, are derived from the judgment of professionals in the various fields. Principally, these inputs are used to weight production, and are provided by the expert opinion of scientists which must determine, in their best professional judgment, the influence of plant pests and genetics as modified by agricultural practices, and the amount of agricultural technology that is in use and its effect, and finally the policy of the national government and the impact of that policy on production.

CROP PRODUCTION MODEL

FIGURE 3

Some technological innovations can have results on both sides of the equation. Irrigation is a good case in point. New land brought into production because of irrigation adds to the Hectares side of the equation, whereas there is expected increase in Yield when irrigation is applied to presently cultivated land. When all agricultural land is brought under irrigation, any new dry farmland is usually located on the poorer soils remaining, particularly in those countries where good agricultural land is scarce. It is recognized that basic data on this subject is extremely poor in nearly every country where it ***is*** obvious that irrigation is important. It is another instance best where it is fairly easy to make parametric statements about technology whereas it is frequently difficult to get accurate cause and effect statistics.

4.2 Plant Pests

There are several aspects of the approach to plant pests (insects and disease) control and eradication that lend themselves to the use of modern remote sensing and surface observation and measurement. While it is not possible to inventory the pests themselves, i.e., insects, bacteria, viruses, fungi; it is possible to inventory the host plants using remote sensing, and in addition, it is frequently possible to detect the effect of the pest on the plant using this new technology. Similarly, while it is not possible to remotely detect the emergence of an insect or the onset of the spread of disease, for example a spore shower, it is possible to monitor the environment and in particular those factors that control these phenomena; temperature, moisture, number of daylight hours, etc. Algorithms have been developed which can merge these alphanumeric environmental parameters, with satellite information, with a spatial precision equal to the resolution of the imagery itself. This permits surface point measurements from in situ sensors, for example, hygrometers, thermistors, etc., to be generalized over very large areas of the image. The conventional approach to the generalization of a point measurement between collecting stations, for example soil moisture, is to treat it as a continuum between stations, or as a gradient between stations depending on whether the values at the stations are the same or different. Neither is necessarily correct. The acquisition of full resolution meteorological satellite digital tapes permits one to map rainfall distribution accurately using the surface meteorological station reports as control. Even in the absence of ground stations, qualitative maps can be made.

In addition to image processing and image correlation algorithms, software has been developed to combine plant growth (phenology) models with predictive climatological, equations into an agro-climatology model, admirably suited to plant insect and, disease modeling and forecasting. Modeling implies numerical equations expressing the reaction of the vegetation to energy as either direct (solar) or converted (nutrient). It is. necessary to consider the total plant environment. Plant growth models are reasonably well advanced and for some species have progressed to the point where simulation algorithms are very accurate, reacting precisely to a variety of environmental pressures both supportive and subtractive towards plant growth and the yield of harvestable material.

Figure 4 represents the structural diagram of the plant pest model and is a classical epidemiological model used for disease processes in plants and animals

PLANT STRESS MODEL

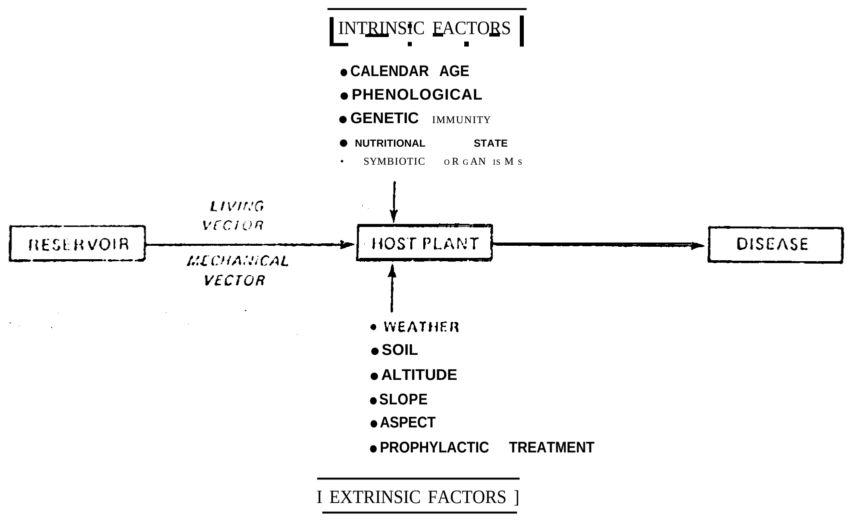


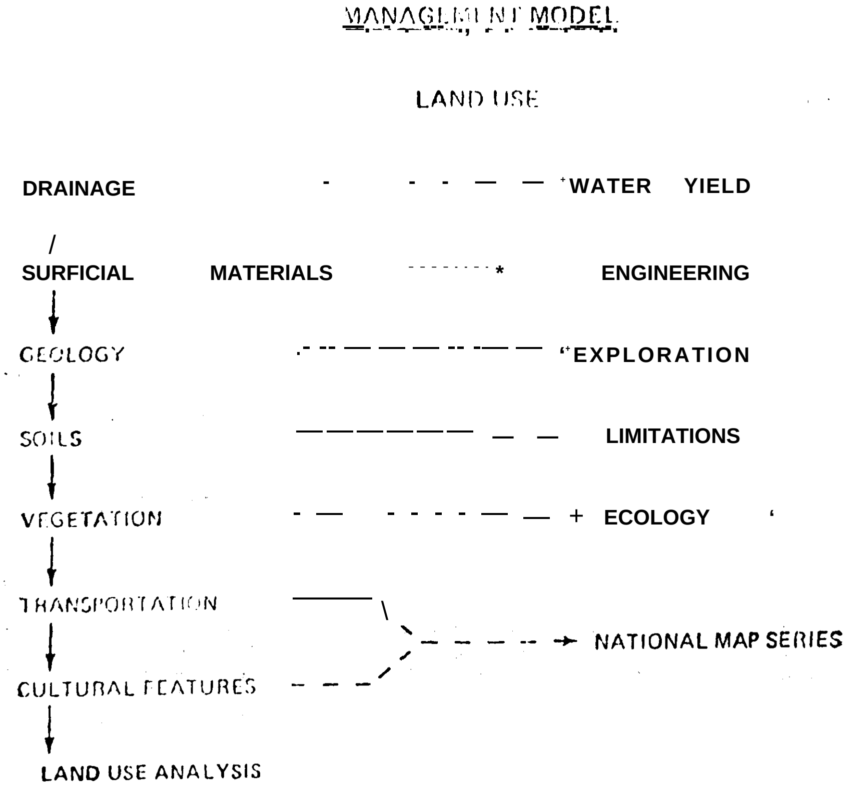
FIGURE 4

as well as man, Note that. there are two groups of factors acting on the host plant; those called Intrinsic factors which are internal to the plant and over which there is relatively little or no control, and those that are Extrinsic, or external to the plant, which are somewhat more variable and in some cases controllable. All of these factors can act in a positive or negative way to either assist the plant in throwing off the attack of the invading organism or acting in a negative sense in creating an environment which is very favorable for the success of the disease organism.

4.3 *Management Model*

LAND USE

The land use model falls into the category of models which are *more* descriptive and narrative than they are numerical. Figure 5 shows the orderly conduct of an analysis function by a multidisciplinary team of earth resource scientists to



for:

1 INTENSIVE AGRICULTURAL DEVELOPMENT

2 RANGE IMPROVEMENT

3. TRANSPORTATION SYSTEM DEVELOPMENT

4. INDUSTRIAL DEVELOPMENT

5 URBANIZED AREA DEVELOPMENT

FigURE 5

create any one or all of the five products that can come from this kind of a land use analysis. As indicated in the diagram the first task performed is an analysis by a hydrologist of the drainage, in the form of an overlay to a LANDSAT image. The overlay is then passed to a geologist who uses this analysis to produce two independent overlays; first the surficial materials, and second the geology overlay. These three products then go to the soil scientist who now has a benefit of the drainage patterns which show him the transport media for the soils, and the geologic materials which assist him in the analysis of the parent material of the soils. These two documents assist him in the preparation of soils maps. All four of those documents now go to the vegetation analyst. It is at this point in the analysis that there is a good deal of interplay between the four scientists who have participated thus far, and the vegetation analyst interacting with the soil scientist can improve the soil survey. Similarly, the vegetation analyst interacting with the geologist can improve the geological overlay. The inverse is also true, that the geologist, hydrologist, and soil scientist participating with the vegetation analysts can improve the vegetation overlay.

The transportation and cultural features overlays can for the most part proceed independently from the first five tasks. Although if the job at hand is the design of a transportation net or the design of the location of a new town or a new urban area then the engineers who would be doing the transportation overlay and cultural features overlay ***in*** fact need the inputs from the other four scientists. If, however, it is a case of straightforward production of a national map series then the job can be done independently.

The team, when finally finished with their independent tasks and with their joint tasks come together, usually under the leadership of a geographer, and perform a land use analysis. This analysis is specifically focused. It may be an intensive agriculture development task or the job at hand may be to improve the range, or to develop a new transportation system, or an urbanized area, or an industrial site selection.

In the Mock diagram note that there are arrows at right angles to each of the integrated tasks which are arrayed vertically. This is meant to imply that there is independent value for each of these overlays.

1. The drainage map combined with topography can be used to create a water yield map.

2. Surficial materials maps showing sands and gravels by themselves are useful engineering data.

3. The geology map is a useful document for a mineral and petroleum exploration.

4. The soils map, although it has a variety of possible uses, has principally been used in agriculture to indicate the limitations to agriculture development.

5. In actual practice most ecology maps are in fact vegetation maps. They may be either natural or man-made ecosystems; nonetheless the principal use for vegetation maps beyond agricultural inventory and development is in the field of ecology.

6. The national maps, and in fact most maps available to the average car driver, contain information on transportation and cultural features.

The reason that this iterative approach is considered a management model is that in practice the use of this type of analysis has been principally a management decision tool to assist in the prioritizing of development schemes.

4.4 Economic Models

This paper does not deal specifically with economic models. There have been a number of cost-benefit studies performed relative to the use of remote sensing and principally LANDSAT data in the natural resource field. One of the more valid criticisms of these efforts has been that cost-benefit studies were undertaken before all the answers were in. This is a perfectly legitimate criticism, and in fact it is quite correct to say that we are still learning what can be done with LANDSAT data. A review of the section on METSATs will show that there are applications cited for METSATs which are not at all what the satellite was designed to do.

5.0 Management Alternatives

This block is really the end of the function that has been served by the data processing and analysis group. They have taken the data from the satellite and from the field and have processed it and analyzed it; they have run it through numerical models of a variety of types, and the final product is a series of alternative decisions. It is not the purpose of the staff to make those decisions. That is left to another group, and as is seen in Figure 1, they are the central figure of the block diagram around which the whole system revolves. They take these management alternatives and make a decision. In the field of natural resources the decisions are usually associated with the exploitation of the resource or its conservation. From that decision process can also flow a request for additional information. That takes us through the information requirement block, which is referred to as the management feedback loop starting the data acquisition system working, and the entire process repeats itself.

Conceptually this is the final point in the design of an information system. There is a very large body of technology available. There is much more to learn, but it is not correct to presume that the decision to go ahead is necessarily dependent on the results of the current efforts, especially in the LACIE program. There have been enough positive results that are sufficiently important for an operational system to be designed around the established capability of the LANDSATs and METSATs and the learning process could go on. There is no reason to delay the decision simply because there is more to learn. There will always be more to learn, and that process will be enhanced by the fact that there is an operational base to the program.

6.0 *Institutional Questions*

There is a very real concern on the part of many countries about the legal and institutional issues raised by a food information system. Even if national sovereignty were not an issue, the protection of the data would still need to be considered because of the opportunity for unscrupulous speculation in the market place. There are at least two precedents which are instructive concerning the handling of natural resource data. There are really five issues involved:

1. Giving the owner (the country) the first opportunity to benefit from the data.
2. Giving everyone in the market place an equal opportunity for fair trade.
3. Providing for the security of the raw data.
4. Providing for the security of national aggregated data.
5. Providing the information necessary for the food information system to function effectively.

The precedent for (1) is found in a method employed by the U.S. Geological Survey in conducting geophysical surveys of very large areas. In this case the owner of the land is provided his copy of the data, derived from his property prior to the publication of the results. A similar convention for the food information system can easily be employed. The precedent for (2) Is found in the present system for handling agricultural statistics by the Statistical Reporting Service of the U.S. Department of Agriculture. The results are released to the public information media at a prescribed time and in a prescribed format in order that no one in the market place has an advantage over anyone else.

A similar global system can be set up on a north-south hemispherical basis, crop-by-crop, for the species selected for inclusion in the system. The best security approach to issues 3 and 4 is to assign the responsibility to an acceptable body and to permit it to establish criteria and procedures to be approved by the countries concerned. Finally, in order to meet the stipulation of ***issue* 5**, the responsible authority would regularly report regional aggregations of these data which would serve to implement the intent of the early warning part of the system and would semi-annually report on a north-south hemispherical basis the data which would implement the food information system as a whole.

It may be undesirable to handle the situation of the secure facility by the usual method of employee security clearance and by the physical security of the plant concerned. There are, however, ways of handling the data so as to protect it. It would be advisable ***in*** any case to take ***measures*** to provide for the security of the data base. Since it would be in computer form, it would be necessary to protect it from inadvertent modification and/or erasure. It is an additional step to provide for complete inaccessibility of the data base via security algorithms. Thus, changes, updates, etc. become procedures which assure major importance requiring the assistance and supervision of a security officer.

These issues may at first appear to be somewhat melodramatic. But they are very real issues which may be the key to cooperation on the part of many countries. Those who remember the first world food conference will recall that the issue of national sovereignty proved to be the principal cause of its failure.

The recent World Food Conference recommended that Food and Agricultural Organization and World Meteorological Organizations take the necessary steps to implement first a global early warning system wherein there would be advance

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warning of serious adverse agricultural conditions in countries, and would provide sufficient warning that the necessary steps can be taken through the Food Aid Program to provide assistance. Secondly, that FAO improve its existing food information system. The World Food Conference even went so far as to recommend certain technological steps to achieve these ends, particularly some of the steps that have been recommended in this paper dealing with crop modeling and agrometeorology.

It is appropriate that the Office of Technology Assessment consider the charge given to FAO and WMO in the light of the realization that much of the technology that could be brought to bear on this problem exists only in the United States; that is, the technological wherewithal is here. There is sufficient scientific talent and sufficient support staff in WMO and FAO in their international offices to provide the manpower required. But the hardware and much of the software exists only here, and certainly the state of learning on the part of these very well-qualified agricultural and meteorological scientists with respect to the remote sensing satellite portion of the technology is not comparable to what is available here in the United States with U.S. scientists.

There is a precedent in part. The World Oceanographic Library is organizationally located in NOAA. It is only partially a precedent because the library itself has no holdings. That is to say, the actual data is resident in many different locations all over the world, and the library is merely a reference center which collates and keeps track of and publishes listings of all of this data. The difference here would be that in addition to an international facility being located in the United States, it would be a functional facility which would have holdings. It would keep raw data, and there are therefore a whole variety of new sensitivities which have to be considered, Finally, however, it should be pointed out that in debates in the United Nations concerning this program it has been stated that if the institutional problems are solved, the national sovereignty issues are very likely to abate.

The principal fear that many of these countries have is that there will be exploitation of their natural resources by multi-national corporations or extranational organizations who have more information about the resources of the country than the country has of itself. The fact that this may have always been true is a non sequitur. The presence of the LANDSAT satellite photography and the policy that NASA has adopted relative to the open skies and free acquisition of LANDSAT photography everywhere in the world has raised the issue afresh. If ***some*** method could be evolved wherein these countries would feel that they are getting as much information about their country as anyone else can get, and that they are getting it in the same time frame, then the issue of national sovereignty would become small indeed since the opportunity to exert their national will more logically comes during the licensing and exploration phase rather than in the satellite inventory phase.

In addition to the institutional questions which are related to the international acceptance of the program, there are those which concern the missions and roles of agencies both national and international. Perhaps the most important deficiency in the system is the current state of surface meteorological observing stations. They are for the m@ part designed to serve the needs of civilian aviation. It is difficult in many cases to use the information because of the location of the station. In all cases it is necessary to do a careful analysis of the terrain around the station before attempting to extrapolate the measurements made at that point to the general area. This task is part of the ecozone mapping function. The . interesting part of this problem is that while it is fairly easy to use an observing station designed for agriculture to meet the needs of civilian aviation, the reverse is not necessarily true. WMO has recognized this problem and has assured FAO that in the future they will recommend to their member governments that the needs of agriculture be given prime consideration.

The fact that WMO can only recommend, is in itself a problem. The WMO is not an action agency and does not design and build observing stations. Agricultural weather forecasting requires many more stations than are presently in the Synoptic Network. It addition, if the existing climatic stations are going to contribute to agriculture they will have to report at the very minimum each 10 days instead of each 30 days as they do now. Here again, WMO can only recommend.

United States agencies are for the most part properly structured, staffed and funded to participate in the system. Agrometeorology is perhaps the most neglected of the contributing sciences. This deficiency is in part related to the lack **of a** clearly expressed need at the State and local level, as well as the Federal level, but also in part because our educational system produces less than 100 agro-meteorologists fit the Ph. D. level per year. It is interesting to note that the USSR produces 500 such scientists each year. Before one dismisses this as an irrelevant observation, consider the fact that the USSR has consistently entered the world marketplace, buying wheat well in advance of their own harvest.

The importance of the program to the developing world, to national governments in the developed world; to the United States Government, in its concern over its national agricultural programs as well as its foreign aid programs in agriculture~ are best illustrated by a final review of benefits of the program. These benefits flow from the successful implementation of a capability to forecast the production of the important food crops. The expected order in which this could occur would be Wheat in year 2; Corn (Maize) in year 3; Soybeans in year 3: Rice in year 4; other major crops in the ensuing years as the physiological models are developed. This information is vital to the following management problems:

1. Import/Export policy.
2. Allocation policy for: Seed, Fertilizer, Pesticides, Fuel, Storage, Transportation, and Port Facilities.
3. Rational land use policies for: Intensive agricultural development. Protective agricultural zoning, Regional development, Industrial site selection, and Urban expansion.

No other source of data so widely serves the management decisionmaking process necessary for the wise conservation and use of our renewable and nonrenewable resources.

SUMMARY

A very brief review has been made of the current state of technology that could be applied to the creation of a Global Agricultural Information System. Because of the complexity of such a System, only the highlights have been documented.

It is the opinion of the writer that such a system is feasible, that both the requisite hardware and software exist, and that the creation of such an operational system would provide the most appropriate base for the orderly development of foreseeable technological improvement. The creed of such an undertaking might be “It is no handicap to good research to have a purpose in mind.”

[The following questions were submitted by Senator Humphrey to Dr. Park and his answers thereto:]

Question 1. What is the relationship of the Earth Satellite Corporation to NASA and to other Government agencies?

Answer 1. Earth Satellite Corporation is a private consulting firm that has performed a number of studies for NASA in the role “of a principal investigator in the LANDSAT program. In addition, the corporation has performed a major cost benefit study under contract to the Department of Interior concerning the costs and benefits related to the LANDSAT program. All of these procurements were competitive and Earth Satellite Corporation enjoys no special relationship with either NASA or other Government agencies.

Question 2. You recommend that a LANDSAT program be made operational. How would an operational program differ from a continuation of the current experimental programs ?

Answer 2. The LANDSAT program poses a special problem for the Government. There is no single operating agency of the Government that has a clear mandate to become the operational agency. There are equally important applications of this particular satellite sstem to be found in the Department of Interior, the Department of Ariculture, the Department of Commerce, and the Corp of Engineers. The term operational, from the point of view of the user agencies, is defined as a commitment on the part of the Government to provide a continuum of data from the LANDSAT family of satellites. If the current experimental program, which is the responsibility of NASA. is supported by that commitment on the part of the Government, it is not only likely that this would satisfy the rest of the operational agencies, it may in fact be the preferred mode of operation. The program is characterized by extremely close interagency coordination which NASA has sponsored. NASA has implemented engineering studies which emphasized the in]] 1:1 of engineering alternatives on the several applications that are the responsibility of the user agency.

The experiment program is sufficiently clearly defined in advance of the flight of any particular satellite that the operational agencies are able to use the data in their regular program. The documentation provided by the writer for the OTA Board discusses the difficulties that have arisen in the field of data processing and data analysis that have occurred in the conduct of the program to date. In my opinion, the only important function that really should be changed in terms of the existing program is a commitment by the user agencies to provide an analytical operational capability that is presently missing *in* some agencies of the Government.

Question 3. What major U.S. Government management programs would be served by an operational LANDSAT program?

Answer 3. LANDSAT data, properly interpreted, can provide information important for decisions made in the management of our water resources, forest and range resources, our agricultural crop resources, our mineral and petroleum resources and in part, our marine resources. Perhaps the most important application for LANDSAT is its utility in the rational use of our land resources. It is correct to say that our concern for the environment can be directly traced in all respects, whether we are talking **about** air pollution, water pollution, or land pollution, to our use of the land. The capability of LANDSAT to first of all inventory this land use and secondly to monitor it over time represents perhaps the single most important use *of* the data. *

Question 4. What types of information from LANDSAT would they use?

Answer 4. The type of information varies with the application. For example, in the case of water, the data are directly interpretable from imagery since the multispectral nature of the imaging system provides a very sharp interface between water and other surface features, thus permitting direct measurements to be made. In the case of mineral and petroleum resources, the interpreters conventionally look for linear features in the data. It has been found that the satellite platform affords a vantage point actually unattainable in any other fashion from which to see structures on the surface that are not just tens of miles long but in fact hundreds of miles long. From these linear features the geologists have made interpretation which has proven to be important to the extractive industries. In other cases, the linears that are noted are circular rather than straight or broken. Generically the data yields information on structures. In the case of agriculture, forestry, and range, the LANDSAT data is used directly since one of the principal scene components is the vegetation itself. The document provided by the writer to the OTA Board discusses the vegetation resource in some detail, and notes that for this purpose the digital data is requisite because of the importance of being able to discriminate between the various species of vegetation on the surface. In the case of the marine resource, the nature of the information is related to conditions in the nursery habitat of the ocean fauna. The satellite has demonstrated its ability to monitor estuarian circulation patterns and to map vegetation in the shore area. In the case of land use, there is a discussion of the nature of' the multidisciplinary analysis that is necessary to extract this data from. LANDSAT and it does indeed require the compex staffing pattern as described in the OTA report.

Question 5. Would it be possible to make better estimates of the crop production in other parts of the world without a cooperative agreement of the countries involved ?

Answer 5. Unequivocally, yes. The estimates could be even better with cooperation but the lack of such agreement does not prohibit better estimates than are currently available for many countries of the world.

Question 6. In your report to FAO, what specific information on crop production did you promise in the first year of operation ?

Answer 6. Specifically, we promised to provide the capability to monitor soil moisture in the monsoon area of India, and the Sahelian ***zone*** in Africa. While. those two areas of the world were stated, it was implied that we would be able to monitor this parameter on a global basis during the first year.

Question 7. Which countries have indicated their willingness to cooperate in the global agricultural information project ?

Answer 7. I do not have the answer to this question. I am informed by FAO that thus far 45 countries had signed the agreement which was a product of the. World Food Conference.

Question 8. In your opinion, how could U.S. Government be of greater assistance to FAO in the establishment of a more effective early warning system?

Answer 8. The U.S. Government has the resources in terms of hardware. software and scientific staff to actually do the early warning system for the FAO. If" this function could be a part of the U.S. Government obligation to the United Nations in my opinion it would be one of the very best investments we could make. in helping to alleviate the world food problem.

Chairman HUMPHREY. Gentlemen, I have a time problem this afternoon, and will have to leave shortly. If it would be possible, I would like to ask Dr. Abel to give us a summary of the OTA Food Advisory Committee report. I would ask you gentlemen to bear with us for a little while and permit us to ask you questions later. Dr. Abel, would you please come forward.

STATEMENT OF DR. MARTIN ABEL, DIRECTOR, ECONOMIC DEVELOPMENT CENTER, UNIVERSITY OF MINNESOTA, MINNEAPOLIS, MINN.

Dr. ABEL. Thank you, Mr. Chairman.

The chairman of the Food Advisory Committee, Dr. Clifton Wharton regrets that he could not be here and has asked me to represent the committee for him.

I would like to make a few comments on the report of the Food Advisory Committee of the Office of Technology Assessment, Food, Agriculture, and Nutrition Information Systems: Assessment and Recommendations. While the views expressed are my own, I have consulted with and benefited from the views of other members of the Food Advisory Committee in the preparation of my remarks.

The Food Advisory Committee report contains 12 recommendations for improving food, agriculture!, and nutrition information systems. These recommendations deal with (a) ways by which the Congress can strengthen its own capabilities to deal with ever-growing amounts of information; (b) ways to eliminate obsolescence and improve the timeliness and reliability of food and agricultural data: (c) the need to improve information on fertilizer, a key agricultural input; (G?) the need to strengthen information systems dealing with current domestic and world food and agricultural situations; (e) development of new technology for improving crop forecasts that utilizes satellites; (f) improving nutrition information systems; and (g) improving international food and agricultural information systems.

The Technology Assessment Board has already heard from several people who have commented on the Food Advisory Committee report and its recommendations. The recommendations stand by themselves. I shall confine my remarks to actions the Congress might take to implement in the near future some of the recommendations of the report that appear to be of vital importance to our information systems, and to the status of further work being done by the Food Advisory Committee on improving nutrition information.

The first two recommendations deal with how the Congress can stengthen its own information and analytical capabilities through (a) increasing the analytical capabilities of staffs of the agricultural committees and the agricultural specialists in the Congressional Research Service, and (b) making fuller use of the analytical capabilities in the executive agencies and the land-grant universities. We recommend that the Congress move quickly in Implementing these two recommendations. Their implementation would provide valuable additional staff capacity to help the Congress implement the other recommendations of the Food Advisory Committee report.

We recommend that congressional action to improve its own staff capability not be limited to increasing the number of professional staff members. Attention should also be given to how to make the professional staff resources more responsive to the needs of the Congress.

Improved communication and coordination of activities among, the Congressional Research Service, Office of Technology Assessment, General Accounting office. Congressional Budget Office, and staffs of the agricultural committees could eliminate unnecessary duplication of effort and achieve a sharper focus of the work of the various, staffs on the important issues that confront the Congress.

These congressional organizations have the authority and resources to draw on a wide range of expertise in the executive branch, in universities. and in the private sector. Coordinated use of these respect ii-e authorities and resources could make more readily available to the Congress a greater amount of information and expertise than is presently the case.

The, Food Advisory Committee and the testimony by Howard W. Hjort highlighted the need to improve the analytical capability and objectivity of the Department of Agriculture in the preparation of supply-demand estimates nationally and internationally. Mr. Hjort outlined several weaknesses in the present system related to inadequate data collection. Inadequate analytical work, and the organizational structure responsible for the preparation of supply-demand estimates with the USDA. Mr. Hjort made several recommendations as to how the USDA could improve supply-demand estimation work including reorganization of units of FAS and ERS within the USDA to achieve better coordination of effort, improved analytical capacity, and greater objectivity.

We recommend that either the Joint Economic Committee or the agricultural committees hold hearings on what USDA is doing or plans to do to improve the quality of its supply-demand estimates. We also recommend that these hearings focus on the need to create an economic intelligence unit within USDA as a way to improve the reliability and objectivity of national and international supply-demand estimates. We think it is important that this unit be independent of the operating agencies of USDA, whose interests may impair the reliability of the information generated.

With respect to obsolescence-of data. the Food Advisory Committee recommends that either the Joint Economic Committee or one or both of the agriculture committees request the Secretary of Agriculture to establish an agricultural statistical review committee to propose to the Congress and appropriate executive agencies ways to modernize, coordinate, and standardize data series on food and fiber.

The appropriate committees of the Congress might. early in 1976, request the Secretary of Agriculture to act on the recommendation. A report of the statistical review committee established by the Secretary might. be made to the Congress within 6 to 9 months. Information would then be available to the Congress and executive agencies for action in 1977 on modernization of our food and fiber data series.

In a similar fashion. the congressional committees which have jurisdiction over the Department of Agriculture and the Bureau of Census data activities could in early 1976 request a study of a joint Department of Agriculture-Bureau of Census committee on the feasibility of integrating the staff and activities of the Agricultural Census into the statistical reporting services of the Department of Agriculture. There could be a report to the Congress within 6 months on this matter. If integration of functions is feasible and desirable, legislation to accomplish it could be proposed earl in 1977.

Our committee feels that the present division of responsibility for data collection seriously impairs the quality and quantity of data being collected and required to run an effective 'agricultural information system. This unhappy situation needs to be resolved as quickly as possible. To date, no action has been taken to reconcile the differences between the Department of Agriculture and the Agricultural Census.

In a paper prepared for the OTA Board, Dr. Harry Trelogan deals with the issues and problems involved.[1] For example, in the 1969 agricultural census there was incomplete reporting of the magnitude of 17.6 percent and evidence indicates that the problem is as bad if not worse in the 1974 census.

The inadequacy of data on Soviet food and agriculture continues to be a problem. While the June 1973 agreement on agricultural cooperation with the Soviet Union has provided the United States with additional data, as Assistant Secretary Richard E. Bell pointed out, ● bThere has been little progress in acquiring data to enable an improved assessment of current production and foreign trade prospects. The Soviets have not yet demonstrated a willingness to implement the forward estimates provision of the Agreement." Yet these are the crucial data needed to achieve orderly production planning and marketing by the United States.

The recent long-term grains agreement between the United States and the Soviet Union is an alternative way of obtaining some information from the Soviets about trade prospects. However, this agreement is only a partial answer to minimizing the erratic price movements in grains caused by large changes in Soviet purchases. The Soviets are free to buy grain from other countries which, like the United States, do not have accurate and timely information on either Soviet grain production or trade intentions. Thus, the Soviets can still influence U.S. markets through their trade behavior with other grain exporting countries.

It may be time for the agricultural committees to take another hard look at just how far we have come in getting needed information from the Soviet Union, why we are not getting more information, and what can be done about it. It may be. as some have suggested, that the Soviet information system does not produce timely information on production and, therefore, trade prospects. If this is the case, it might be worth considering ways by which the United States might help improve the timing and reliability of Soviet data. If. on the other hand, such collaboration is not possible or desirable, then continued efforts will have to be made to find ways to keep the Soviet Union from unduly disrupting world grain markets.

Additional recommendations of the report deal with ways by which the United States can help other countries improve their agricultural information systems. We recommend that the Congress request the appropriate executive agencies to encourage and support development of FAO's efforts to expand its global information and early warning system on food and agriculture, consistent with resolution XVI of the 1974 World Food Conference.

1 See P. 326.

Amen other things, strengthening of domestic food and agricultural information in other countries will be required. The Statistical Reporting Service has valuable experience and expertise for doing this. Consideration might 'be given to the Statistical Reporting Service playing a bigger role in assisting other countries to improve their food and agricultural information systems. The United States might also provide financial assistance to these nations for this purpose.

The Food Advisory Committee recommends that the Agency for International Development be directed to place high priority in its foreign assistance program on helping less developed countries im- . rove their information s stems, including the use of advanced information technology. TZe appropriate congressional committees might in 1976 explore with AID how it can expand its technical assistance efforts to improve national agricultural information systems. This exploration could be part of the appropriation hearings for the fiscal year 1977 budget.

One aspect of the report requires further comment. The Food Advisory Committee indicated their 'plans to consult further with leading nutritional scientists and make recommendations for establishing a continuing nutritional status surveillance program.» The Food Advisory Committee report quoted the testimony of the Nutrition and Special Groups Panel of the June 1974 national nutrition policy study, in which concern was expressed that "recent studies have added little to our knowledge and completely ignore questions which we feel must be answered if the United States is to develop a sane and equitable nutrition policy."

The Food Advisory Committee report went on:

> Nutrition scientists also are not fully agreed on the significance and reliability of specific tests for nutrition deficiencies. Information on nutritional status also involves consideration of nutritional-related public health issues, where in many instances cause and effect relationships are not clearly established. It is because of these problems that little progress has been made in establishing a monitoring and surveillance program as recommended by the 1969 White House Conference.

Since information on the nutritional status of target groups on a timely and continuing basis is essential to the development of policies and programs, it is essential that the Congress and other agencies of government have accurate and timely information on the nutritional status of target groups in order to develop and implement effective " policies and programs.

Since other areas of nutritional concern are so dependent upon the quantity and quality of information concerning the nutritional status of individuals and target population groups, the Food Advisory Committee plans to review national nutrition surveillance and related programs and make recommendations on alternative ways to provide the information required for developing and implementing nutrition policies and programs.

I have a statement prepared by a subcommittee of the Food Advisor-v Committee that goes into more detail concerning the plans and activities of the Food Advisory Committee in the nutrition area and I would like to submit that for the record.

Mr. BROWN. Without objection that will be inserted in the record.

[The above-referred-to statement of Dr. Nesheim follows:]

STATEMENT OF DR. ROBERT NESHEIM, CHAIRMAN, NUTRITION PANEL OF THE FOOD ADVISORY COMMITTEE BARRINGTON, ILL.

In June 1975, the Food Advisory Committee (FAC) issued their preliminary assessment and recommendations on food, agriculture, and nutrition information systems. One of the assumptions underlying their recommendations is the need for a national nutritional status surveillance program. The FAC indicated their "plans to consult further with leading nutritional scientists and make recommendations for establishing a continuing nutritional status surveillance program." The FAC report quoted the testimony of the Nutrition and Special Groups Panel of the June 1974 National Nutrition Policy Study, in which concern was expressed that "recent studies have added little to our knowledge and completely ignore questions which we feel must be answered if the United States is to develop a sane and equitable nutrition policy." The FAC report went on:

"Nutrition scientists also are not fully agreed on the significance and reliability of specific tests for nutritional deficiencies. Information on nutritional status also involved consideration of nutritional-related public health issues, where in many instances cause and effect relationships are not clearly established. It is because of these problems that little progress has been made in establishing a monitoring and surveillance program as recommended by the 1969 White House Conference."

Thus, one of the results of this report was the development of a nutrition panel as a sub-group of the FAC, whose immediate goal is to assess the quantity and quality of the nutritional information necessary and available to Congress and the improvements that can be made in this regard.

The Panel is chaired by Dr. Robert Nesheim, Vice-President of Research and Development, Quaker Oats Company. The other panel members are Mr. Arnold Mayer, Legislative Representative, Amalgamated Meat Cutters and Butcher Workmen of North America; and Mrs. Esther Peterson, President, National Consumer League and consumer advisor to the president of Giant Food Incorporated.

Additionally, in September a nutrition conference workshop was held in conjunction with the Community Nutrition Institute. The workshop report provides a basis for exploring the impact of food technology on nutritional values of food and also analyzes the effectiveness of the RDA as a nutritional standard. This report will provide a sound background for present, proposed, and future assessments.

Nutrition Information Assessment

Although Congress has passed dozens of bills affecting the nutritional status of Americans, surprisingly little is known about the nutritional status of this nation. In an effort to alleviate hunger and the manifold problems related to it, numerous food delivery programs have been legislated and implemented. These programs are aimed at providing food to the target populations believed to be most in need of supplemental nutritional assistance. Thus these programs attempt to provide a level of nutritional sufficiency to the target population. This assumption raises many poignant questions relating to the quantity and quality of the information which Congress received prior to making these determinations. How is the target group selected? Who are the nutritionally deficient in this nation? What are their deficiencies? Why do deficiencies exist in their diets?

a. Inadequate purchasing power.
b. poor selection of food items from money available.
c. Cultural food habits.
d. Inadequate preparation facilities. etc.

What are the nutritional requirements of the population? Are these programs, in fact, meeting their intended objectives?

Because of the serious implications these questions raise as to the adequacy of ***channels*** of nutrition communication ***and*** the quality of information available, the nutrition panel will explore in depth the nature of available and necessary nutrition information and examine how it might be used in Congress.

In an effort to assess the extent and adequacy of nutritional information, it is essential to study the various components of the nutrition process and the information flow related to it.

Although several studies are presently being undertaken or considered which involve analysis of various components that we will evaluate, it is important to note from the outset that their thrust is not identical to ours.

The National Center for Health Statistics, HEW, is now administering Health and Nutrition Examination Surveys (HANES) to obtain data for use in national health program planning. Although the information is being collected on a rather small scale, this will be among the information networks that our assessment will evaluate. Furthermore, the Administration is considering the establishment of a multi-agency federal food consumption data bank. It is anticipated that our assessment will be of assistance in establishing and implementing such a system. It should also be pointed out that the Food and Nutrition Board of the National Academy of Sciences will be updating the Recommended Dietary Allowance (RDA) guidelines in the near future. Such an effort, however, will not overlap or infringe upon the nutrition panels proposed undertaking.

This assessment will, in fact, analyze the information input and utility of the RDA to the consumer and, if necessary, propose improvements. It is anticipated that our assessment may utilize and analyze other studies being done, but it is not expected to duplicate the research effort of these studies.

Before Congress makes any decisions regarding food delivery programs, members should be aware of the nutritional state in this nation, Thus it is imperative that a knowledge of the nutritional status of the population and its various segments be obtained. Several attempts have been and are presently being made to accomplish this formidable task.

Presently, there are government agencies gathering varied and often overlapping nutrition information. Both the USDA and HEW are involved in food delivery programs and have to some extent gathered nutritional information and statistics relating to the nation's population. There is, however, no clear, concise understanding of exactly what or how much information each agency collects or distributes or whether the frequency of the surveys is adequate. Neither has there been an analysis of the collection processes. If a national surveillance System is to be implemented, an evaluation of the information presently being collected would be a first step. This system should indicate the magnitude and extent of nutritional deficiencies by geographical area, income level, age group, ethnic group, and other identifiable characteristics. It would be necessary to evaluate proposals for surveillance systems considering such questions as: How should the sample to be monitored be drawn? Are there particular groups which should be observed because of suspected nutritional problems? Should the information be gathered by a government agency or through a contractual agreement with a private firm?

How often should the information be reported? How shall it be collected? Moreover, it would be necessary to consider the type of information which might be collected: Should the monitoring be conducted on a random sample of the population or merely on certain specified target groups? Should the existing food delivery systems be monitored for effectiveness in their ability to reach their target groups and/or for the nutritional quality of the food delivered? Nutrition surveys tend to be expensive and time-consuming. Are there innovative approaches that can yield timely and useful information on a cost-effective basis ?

These are some of the most obvious questions, the answers to which would help Congress determine if a survey and surveillance is feasible or even desirable. our objective will be to explore the questions that would have to be addressed in establishing a surveillance system, evaluate the information that we have presently and/or need to obtain, and outline the alternative surveillance options available to Congress.

Food Consumption

Since people require nutrients but eat foods to obtain these nutrients, it is important that we have sound information on what people eat. First, we must collect and analyze the existing surveys of food consumption, most notably the USDA's Household Food Consumption Survey (HFCS). This should be evaluated with regard to the adequacy of the survey's consideration of differences between the total household consumption and the consumption level of individual family members as well as differences between consumption levels based on age, sex, ethnic group. income. and geographical areas, Varying food consumption habits result in deviations in nutrient intake.

Thus. it is essential to monitor food consumption habits to maintain information on the nutritional status of key segments of the population and thus gain some insight into the nutritional status of the population. In this respect, we should analyze the differences in quality and type of food consumption for each group and the effect of these differences on the health of individuals within a particular group. The end result will be to state the options available for implementing a survey of food consumption with cost and feasibility alternatives.

We will, at the same time, attempt to synthesize the existing information into a cohesive framework. In doing so, we will gain insight into the quantity and quality of information that is currently available, how these sources of information contrast with each other, and how they can be improved.

Food Composition

Because people eat food but require nutrients, it is essential to determine the nutrient. composition of specific foods, both processed and unprocessed. Many recommendations have been made as to possible methods of analyzing food composition. It is important to determine what these theories are, how they relate to each other, and where they differ Additionally. these must be assessed in terms of their ability to be implemented in a continuous and consistent manner for all foods.

The USDA has for years been determining and recording the composition of a broad spectrum of the foods available for American consumption, Known as Handbook 8, this volume has been relied upon by all ***segments*** of the food delivery chain for ready reference on food composition. Thus one task before the nutrition panel will be to examine Handbook S to determine if it provides a comprehensive analysis in terms of food surveyed and nutrients enumerated ability to remain current, validity of findings, and dissemination of information t to the public in a comprehensible manner.

Consideration should also be given to the following:

Which nutrients are or should be included in the analysis?

Does the Handbook properly reflect the influence of processing and storage on nutrient content of foods as delivered to the consumer?

Does the processing and storage technology differentially affect the nutrient content of food? What are the trade-offs in terms of food availability, nutrient preservation and economic viability ?

Thus the assessment should evaluate whether it is in fact possible to validly and in a meaningful manner analyze the nutrient content of foods in light of tile technology applied in the food chain and to summarize it in a meaningful way which can provide timely and useful information for use by the various users of this data.

Nutrient Requirenments

Nutrition is intrinsically related to health. It is impossible, however, to recommend nutrient intake levels of individuals without an evaluation of the nutrient requirements of these individuals. Moreover, an assessment of nutrient requirements should evaluate the feasibility of considering the varied requirements of different segments of the population based on age, sex. present state of health, and environmental situation.

Any assessment of nutrient requirements should also examine the RDA-what it is, what information it utilizes and provides, and how effective it is. Particular attention should be given to the RAD and its ***users,*** since this is used extensively in measuring adequacy of nutrient intakes. recommending diets. evaluating nutritional needs, etc. Further, other suggestions for establishing nutrient requirements should be considered and analyzed with attention to ease of obtaining information, cost, timeliness of obtaining results, and the validity of applying the information to the target population.

What we must bear in mind in considering each of these components is that this assessment will deal with information options rather than with policy alternatives. By enumerating the nutritional components and evaluating the available information in terms of quantity. quality, what information is needed find how, or if, it can be obtained, we will have completed the first step towards helping Congress to formulate a nutrition policy. If this is to be achieved. it is only with quality information in sufficient quantity that responsible decisions can be made.

OTA's Board has approved a request by Congressman Tom Foley, chairman, House Committee on Agriculture: Senator Herman Talmadge, chairman, Senate Committee on Agriculture and Forestry : Senator George McGovern, chairman, Senate Select Committee on Nutrition and Human Needs; and Senator Humphrey to develop and evaluate alternatives in U.S, food policy. This request will initiate a number of OTA studies to be undertaken in the next year. Initially, the staff and advisory panels will assess available nutrition information, nutrition gaps, and research priorities. This overall assessment will provide us with an opportunity to evaluate numerous aspects of nutrition in America and develop alternatives to issues which will be useful to Congress when considering nutrition policy alternatives.

This assessment is expected to be conducted simultaneously with the nutrition information project, with which we are presently involved. By the year's end we believe we will have made a significant contribution to the nutrition information needs of Congress, whether it be for individual legislation or comprehensive nutrition policy formation.

Mr. BROWN. We want to express our appreciation. I know the Board will pay close attention to the full report, particularly Senator Humphrey who has played the leading role in encouraging the work of your committee, and it will be included.

Would any of the other members of the Food Advisory Committee like to add any comments of their own with regard to the report, or their activities with regard to the committee?

Mrs. PETERSON. I would like to submit a statement for the record.

Mr. BROWN. Without objection it will be made a part of the record at this point.

STATEMENT OF ESTHER PETERSON, VICE-PRESIDENT, CONSUMER PROGRAMS, GIANT FOOD, INC., LANDOVER, MD.

Mr. Chairman, members of the Technology Assessment Board, I appreciate the opportunity to present my views on the activities of the Food Advisory Committee of the Office of Technology Assessment from the consumer viewpoint. I have served on many advisory committees, and I hope to continue to do so. Few, however, have been more challenging or more elusive than the Food Advisory Committee.

My perspective has developed through daily contacts with consumers in the supermarket.

I work every day with customers who ask me for help about how to make wise choices among the foods in our stores. (10,000-12,000 items) A growing number want to know how to make their food purchases more meaningful to their diet and health. Consumers want expert advice, and I have been trying to find experts to provide that advice.

I can find experts who disagree with other experts;

I can find experts who tell me that consumers are expecting more than science can deliver;

I can find experts who tell me that we need a lot more research and information;

But it's hard to find experts who can help consumers by providing reliable standards to deal with a food system where man's technology may have more influence on nutrition than Mother Nature.

I face many problems as a consumer advocate as I testified before the Committee on Science and Technology last September.

For Example:

1. We are told that on the average Americans eat twice as much protein as they need. In our diet, protein sources are the largest single cost item. If we need less protein, how do consumers adjust their food planning to this condition? There is no official acknowledgement of this overconsumption rind, therefore, no public resources are available to supply educational information and materials. Instead, the Congress passed a bill from the Agriculture Committee which would have Congress endorse a public policy to eat more meat. It is back in committee now, I'm told, but not because the public is to be informed of the facts or told of the dietary options they should consider. No, it's only because the two Houses cannot quite agree on the wording of the same fundamental policy to eat more meat.

2. There are problems which arise because technology has gotten way ahead of our understanding of nourishment. For thousands of years, nature has put trace elements in our food. We have adapted to them. In less than 50 years, however, man has put "trace elements" in our food supply as "additives".

Now some of our children seem to be telling us that technology's trace elements, these additives, are having strange and harmful effects on their health. Dr. Benjamin Feingold, a physician who has studied the effect of technology's trace elements in children, has evidence that seems to show that diet control can reverse hyperkineses, or hyperactivity.

Some food technologists and some in the nutrition field argue that food additives are necessary and essential to sustain our food system. But a sharply rising cancer rate makes consumers question how much longer we can tolerate continuing changes in our environment which includes the foods we eat.

Scientists say we must conduct research and evaluate the data from these conflicting viewpoints. But in the meantime, what is the consumer supposed to do? Life is not a process of waiting for experts to agree on research topics.

3. What about nutrient changes in pre-plated and fully processed meals, including those served in and outside of our homes and in some school lunch programs? A large part of our population eats at least one meal outside the home every day. Here we find ourselves confronted with more technological innovations in preservation and preparation, the effects of which are fundamentally unknown. We are way beyond cooking and freezing as the consumer understands it; using the stove and refrigerator freezer is as far as most o?' us have progressed. Once again, we just don't know what's happening to the food we hope is nourishing us. We don't know the answer to the question, "Is it nourishing?" To say nothing about taste!

4, Technology has made possible the growing and processing of fresh fruits and vegetables for quantity production. Let us not forget that ultimately these products must be eaten. Fresh fruits and vegetables are technologically ripened, colored and processed to preserve freshness and to extend their handling time. In some cases, these products carry pesticide residues, and they may be sprayed with a waxy substance to seal them from the atmosphere; Experts set residue limits and they tell us the coating substances are safe, but the Food and Drug Administration proposed banning PVC (polyvinyl-chloride) coatings on citrus fruits as a health hazard. Who should the consumer believe? What can I tell consumers? I wish policy could be bent more toward the position of "when in doubt, leave it out".

5. Food grading illustrates where consumers' buying needs are beyond agriculture's thinking. We all are aware that the food grading systems follow no uniform standard, and they are very confusing to consumers. I applaud the proposed rationalization of these grades by the USDA, but still the basic intent is not to serve the consumer's need for nutritional information. Food grading is cosmetic. It is a description of appearance.

Most of us have eyes. We may not judge appearance like the experts, but really we can make an approximation suitable for our needs. What consumers don't know is nutritional value. What's not talked about to the public is that grades, as done now, are not signs of nutritional quality. In fact, I'm told that the nutritional content of all the grades is quite similar. Where does this leave the consumer? When we buy for quality we are paying more than necessary for nourishment.

Consumers want and need this very basic information and yet we do not appear to have the data to develop a nutritional grading system. Of course, it may be that we will not need a nutritional grading system for some processed foods if we develop such programs as percentage of ingredient labeling in conjunction with nutritional labeling. The aim must be basic nutrition information for the consumer.

6. Processing may reduce or eliminate nutrients from food. It also can restore nutrients and add others which were never an important part of the basic food.

In a few instances, such as Vitamin "D" in milk, or iodized salt, the added nutrient was placed there largely as a public health measure.

However, in typical fashion, some food processors have assumed that if some is good, then more is even better. Now we find ourselves with highly fortified cereals and snack foods, and the prospect of much more.

We are in the position of wanting a food supply that is nourishing, but we do not know for certain what is happening to our health because of the nutrients being lost, or why they are disappearing, and we are not prepared to say what will happen to the nutrients we are adding to food products. We do not know if there is a cumulative effect, nor do we know whether the loss of one nutrient will cause harmful effects because it was necessary to the function of another nutrient, or if the adding of one will unleash harmful properties in still another.

These are the implied questions in the consumer query: "What's a good cereal for my child?" It isn't a simple question, and there is no easy answer.

It is from these day to day problems of consumers that I derive my perspective on the Food Advisory Committee.

We were charged with advising Congress on the impact of technology on the food system.

As I recall, we had some difficulty at the outset in defining the purpose of our activity, and in identifying the particular goals we would hope to achieve. The decision was to assess the agriculture information systems and to improve their capability for agricultural policy planning. This was at a time when the very structure of policy development in agriculture seemed to be disintegrating, when the cost of food was rising very fast and its availability to U.S. consumers did not appear to be a national priority.

I felt and tried to indicate, that we were starting at the wrong place. I tried to say so, and thought no ***one*** was listening. It seemed to me that we had to define the policy framework within which an information system would function. Otherwise, it seemed we were saying, in effect, that the breakdown in the food and agriculture policy could be corrected by simply improving some of the internal data mechanism and evaluation procedures. We were chasing mosquitos and ignoring the swamp.

I expressed these thoughts in three letters of dissent to the Food Advisory Committee Report, one to Clif Wharton and one to Mim Daddario on June 10th. 1975, and a later letter of clarification to Clif Wharton on July 30th. I would appreciate these letters being made part of the record. I ask this to illustrate the difficulty that a lay person encounters while trying to bring policy matters into focus for the benefit of the end user.

I am thankful, Senator Humphrey, to note that you held a hearing in December where three papers on the shape of a food-farm policy for the future was presented. Two of those papers dealt with the substance of food-farm policy, including one co-authored by my fellow committee member. Lauren Seth. The third paper analyzed the administrative structure which has evolved within the executive branch to deal with food policy issues. a structure which reflects the absence of a food policy and the inability of Secretary Butz to recognize the problem. I wish I could have heard the discussion at the time those papers were presented, and I wish they had received greater public attention. But I am pleased that OTA has now begun to set down a frame of reference in which to consider food and farm policy issues.

I would like in this testimony to add a consumer dimension to the policy structure which has been proposed, primarily to ensure that policy considerations include both food and farm issues. The two are but one sphere, although too often the food problems are treated as the dark side of the moon, never visible.

For clarification purposes, I want to define food policy as a framework for issues of concern to users of food, or consumers. Farm policy relates to issues of concern to producers, and is production oriented.

Farm policy and food policy obviously have many common features; there are more similarities than differences and the differences are often matters of emphasis. Food policy, because it deals with many areas of concern that production issues do not touch, is broader.

The following outline of a national food policy will give you specific examples of these general concepts. I think you will recognize many of the elements in the nine-point consumer food policy. They are, in fact, the same as those in the Cochrane and Soth paper presented at the December 10 hearings. We began formulating our consumer policy papers with an earlier draft of a farm policy statement prepared by Dr. Cochrane.

The first element of a food policy is a National Food Budget. It contains four components:

1. Domestic commercial and food assistance requirements.
2. Commercial exports.
3. Foreign aid commitments.
4. Supplies required to maintain food reserves, once a domestic and world reserve program is developed.

We would measure domestic requirements in terms of RDA's, the Recommended Dietary Allowances which state individual food needs in nutritional terms. This not only will convey to the individual citizen that national food policy is committed to nutritional adequacy for each person, but also enable planners to include the needs of those at nutritional risk, such as the poor, the elderly, pregnant women and infants. National policy should not only reflect production goals, but also health and social goals.

At some point, domestic requirements would be converted into units of bushels, pounds and acres, terms which have meaning to producers and which are necessary to production planning by farmers. Domestic production needs would be added to commercial and foreign aid expert goals and these production {objectives would be expanded to include whatever reserve supplies are needed for the year.

The second element is a food reserve.

The third is a production incentive program—price supports, incentive payments, loans-to enable farmers to meet the needs set forth in the national food budget.

The fourth element is an export policy which would specify that the domestic requirements in the national food budget are guaranteed. It also should include a commitment to long-term foreign aid commitments.

The fifth component of a food policy would be a commitment to producers that farm prices would be guaranteed at a level no lower than an average of a specific period, such as the previous three years.

The sixth element is a research program in the technologies of producing, processing and distributing food with two general goals: insuring adequate nutrition and securing a food supply at a lower real cost.

The seventh objective of a national food policy should be to promote and strengthen competition in the food growing processing and distribution sector. The National Food Marketing Commission warned 10 years ago of the advancing threat of economic concentration in some areas of the food industry. Our food industry is a creature of technology, and, in the absence of any other force. the cost of new technology could cause the food industry to become more concentrated with the passage of time.

The eighth component of a national food policy is a commitment to domestic and foreign aid programs to prevent hunger and malnutrition at home and abroad. We would suggest that nations which seek food assistance be expected to make the same commitment to improving the nutritional status of their citizens as is spelled out in a U.S. food policy.

The ninth element of a national food policy is an educational program based on expanded research in human nutrition. Thus we will increase our knowledge of the relationship of diet and health, improve the capacity of our health programs to employ diet as a preventive measure to control disease and illness, and through education translate such knowledge into lay practice.

The three major killers of the American people-heart disease, cancer and diabetes-are related to the food we eat. Yet we know very little about the relationship of diet and health. We do not as yet have a research program specifically for that purpose, and we do not apply what little knowledge we do have to any great extent.

I feel that any national food policy proposal must be able to demonstrate that it will promote the consumers' welfare and assure adequate nutrition, that it will improve food productivity and maintain a stable food system, and that it has the capacity to alleviate famine and malnutrition abroad while maintaining our international economic position.

I believe that the consumer food policy proposal will help attain all these goals. Let me emphasize, however, that there is much more left unsaid than stated, and that much work remains to be done in specifying the structure and process which will be necessary if the policy is to be implemented.

However, the first step is to describe the problem and outline an approach.

I am glad to see the Food Advisory Committee is now directing its attention toward the areas of food policy and nutrition where I had originally hoped to find it. I feel now that the direction is set, I hope I have made the contribution I wanted to make.

With the recommendations for farm and food policy that have been presented at these hearings, I feel that the committee has all that it requires to get on with the task of helping develop a total food policy for this country.

Consumers will be watching closely. In a year's time I trust we will be able to review substantial progress toward our goal. By then I hope a blueprint will be ready for the achievement of a comprehensive food policy for the United States, one with ***broad enough*** scope to fulfill domestic and world needs, making use of the many benefits that properly directed technology can provide.

[The following information was referred to on page 346 of Mrs. Peterson's testimony:]

JUNE 10, 1975.

Mr. EMILIO Q. DADDABIO,
Director, Office of Technology Assessment,
Congress of the United States,
Washington, D.C.

Dear MIM: I cannot endorse this report.

To me it looks like the committee lost focus of our original charge of helping to develop an improved information system in the food area. In so doing, I am afraid that the issues have been dealt with in a narrow and superficial manner and in some instances the report draws inaccurate conclusions. It would seem from this report that the committee has totally missed the point that the purpose of agricultural production is good nutrition.

While there are sections with which I agree, and while I generally find the material a useful summary of the information infra-structure in agriculture, the section on nutrition is an absurdity. Accepting this report would not be " fair to my colleagues who have worked with me these past eight years. I cannot ask them to accept this report and my view of our joint effort. Nor could I expect the members of the Congress to adopt the distorted view this report gives of the advances in food and nutrition which occurred largely because of Congressional initiative.

In addition, I find it difficult to accept the kind of logic which purports to show that the Food and Agriculture Organization cannot justify its estimates that 400 million persons in the world in 1970 were malnourished. The report makes the same error which has characterized our food and nutrition policy since the end of World War II by suggesting that the problem doesn't exist since we can't count, test, or measure every individual case of malnutrition.

There is much that is simple carelessness in the report ***on*** nutrition. While the food consumption surveys of 1945 and 1955 are used to justify a conclusion that the nutritional status of Americans had improved in those years, there is no mention of the 1965 survey which was the first hard evidence that the nutritional status had begun to decline. This conclusion was reinforced by the ten-State survey carried out by H.E.W. in the late 1900's and by the HANES survey completed only recently by H.E.W. Is a reader to assume that the committee does not believe the food consumption surveys are valid, and cannot be used to justify ***a*** finding of growing malnutrition?

The concept that nutrition planning must begin with blood tests of! each individual is a preposterous strawman. The basic data required for adequate nutrition policy planning can be provided through refinement.s in the presently available Recommended Dietary Allowances, and the reliability of a planning system based on these data can be improved through such monitoring techniques as a statistically valid sampling of individual blood tests.

The recommendation that hearings be held to question the directors of U.S.D.A.'S and H.E.W.'s surveys on nutritional status begs the real question. The Administration has delayed the U. S.D.A.'s 1975 food consumption survey for two years, and still will only permit tests of proposed survey techniques. Ask the Office of Management and Budget how it can justify delaying the gathering of vital information.

The basic reason why I must decline to sign this report is that the treatment of nutritional policy needs betrays a total inability of the Committee to accept any conceptual basis for food and agricultural policy other than its economic role. Nutrition and health are closely related, and health data is difficult to obtain and even more difficult to apply in planning. Food, however, is more a social than a health issue. I find the emphasis on blood tests—which are objectionable to most people-is only a very polite way of telling the committee members that politically the Congress can deal with food only as a production, or economic issue.

As committee members, we ***were*** expected to provide new ideas and new concepts. We are, however, recommending that the solution to Congress' inability to cope with the changes which technology imposes on laws and legislative policy is to do just a little bit more of the same. I do not believe this, and have tried to express by concern with little apparent success.

I request that my name be withheld as a signator to this report and that this letter setting forth my reasons be affixed to the report.

sincerely,

ESTHER PETERSON.

June 10, 1975.

Dr. CLIFTON R. WHARTON, Jr.,
President, Michigan State University,
East Lansing, Mich.

DEAR CLIFF: I tried to reach you on the phone and find you are away till Friday. On Friday I hope to be sitting on a mountaintop in Vermont, far away from telephones, so excuse, please, having *to receive a* letter when a telephone call would be far more pleasant.

First, I regret neglecting to answer your letter of May 23. It literally "fell between the cracks". I will respond to your request for suggestions of people for future O.T.A. work in the food nutrition area. I will also give some time to your request to identify a small set of key documents addressing the question of food nutrition achievement.

The major purpose of this letter and what I had hoped to talk to you about over the phone is to inform you that I cannot sign the Wilcox report. I am sending you a copy of the letter that I am sending to Mim with the report, which carries some marginal comments. I am sorry to have to do this, but I do feel, in all good conscience, that I must.

I will leave for further discussion the question as to whether or not I should resign. I do not want to do this without consulting with you, Therefore, I will hold that decision a bit longer.

You know I have enjoyed working with you and I appreciate you leadership through a very difficult, confusing and frustrating situation.

Sincerely,

ESTHER PETERSON.

JULY 30, 1975.

Dr. CLIFTON R. WHARTON, Jr.,
President, Michigan State University,
East Lansing, Mich.

DEAR CLIFF: I take no pleasure in withholding my signature from the Food Advisory Committee report. I write this with deep and heavy regret. I accepted the invitation to serve on the Committee with a sense of hope that many of the problems and weaknesses of food information systems which previously have been overlooked would be addressed in this technology assessment. I cannot help but feel that I have failed my colleagues on the Committee, by failing to express my concerns early enough or strongly enough to elicit an adequate response.

The draft report as presently revised is much improved in its rhetorical analysis of the present situation, but the recommendations on an improved information system which led to my initial letter of concern on June 10 remain unacceptable.

In my judgment the report remains narrow and superficial. It stops short of any attempt to make an in-depth evaluation of the impact of modern technology techniques on information systems or to consider how information systems might be used for policy-making decisions in the Congress. Anyone reading this report could conclude that somehow the difficult times of this decade could have been avoided by doing a little bit more of what we have been doing for two generations and that the subject is just too cumbersome to consider in the first place. I doubt that any legislator would be motivated to use this report as a basis for an approach to future policy-making decisions.

The report still leaves the impression that there is only one goal as it relates to "agriculture"-namely, production. The concept of nutrition being an integral part of the food system seems to be anathema to the Committee. I once again will reiterate my strong feelings that agricultural production should be considered in the context of meeting the food needs of consumers. It seems to me that an intrinsic part of a technology assessment in any field is the realization that value as well as volume must be the goal of the utilization of technology. Any analysis of an information system should have taken this into account.

My own feeling is that the portion of the report which summarizes the government information infra-structure in-agriculture should be appended to a more substantive report which would meet the full charge of the Committee. My colleague, Martin Abel, has pointed out that the private sector is responsible for a good portion of the research done in agriculture today. The Committee has not begun to take into account the impact of this change in control and orientation of food research.

I am pleased with the decision to move ahead in the nutrition information area, and I am hopeful that the recommendations that flow from this effort will meet the purpose set forth by the Congress in establishing the O.T.A.

The basic function of O.T.A. "is to help legislative policy makers anticipate and' plan for the consequences of technological changes and to examine the many ways, . expected and unexpected, in which technology affects people's lives. O.T.A. provides Congress independent and timely information about the potential effects and side effects-both beneficial and harmful-of technological application."

I do not feel that I can comply with this purpose and sign the draft report.

Sincerely,

ESTHER PETERSON.

Mr. BROWN. Thank you very much for your contribution.

Are there comments from any of the other members of the committee ?

If not, I want to express my appreciation too to Dr. Abel for making his report, and as I say, it will be considered in much greater detail by both the staff and members of the Technology Assessment Board, and I suspect we will want to follow up on that.

Now, if I could get back for a moment to the panel. I think there may be a few questions which we might raise here.

One of the questions which I would like to pose, because the point was mentioned several times, was the degree of probability that we will be able to continue with this remote sensing program. Apparently the Landsat D is not committed. There are uncertainties about it.

I wonder, Mr. Matthews, if you could give us any indication of the extent to which NASA's planning has made it possible to predict whether we will go ahead with this program.

Mr. MATTHEWS. Mr. chairman, there is no basis to say that the program will continue at the present time because although we have a satellite planned for launch in 1977, there are no specific requests in the budget for anything to follow up on that activity.

I do want to point out, however, that we have under development this new sensing instrument that I spoke of earlier which does imply that a system will in fact be in existence in the future and hopefully in the near future.

The third Landsat which will be launched in September of 1977, might last 2 or 3 or 4 years if we are very, very lucky, In that case, I would think we would have a Treasonable chance of continuity particularly if it lasted 3 or 4 years.

Mr. BROWN. You don't know if 'budgetary commitments would give any assurance beyond that period of time ?

Mr. MATTEWS. That's correct.

Mr. BROWN. Would this matter be affected by the degree to which user programs were developed on a more significant basis among the various departments, and is there something here that needs to be given attention? Can you speak to that point ?

I was interested in a comment made by one of the gentlemen about the user committee that has been set up and the degree to which the development and the identifying of high priorities for some of these uses might be an input into the budgetary process that would allow us to make some commitments.

Mr. MATTHEWS. I really feel, Mr. Chairman, that the using communities both at the Federal level and at the State level, as well as the international using community, are very much behind this program and have moved their activity level as rapidly as the technology that is available to them has allowed. Indeed I think many of these activities have very practical connotations right now.

Perhaps you recall that in testimony before the House Committee on Science and Technology, people in the geological area were talking about actually finding minerals and peroleum. There are many more examples like this.

So I think the using community is very much involved with the program and is using it.

I do think that there is the concern in the using community relative to the future and this is natural when a system is providing a valuable capability.

Mr. BROWN. Well, I know that many of us on the House side are concerned about a longer range of planning. I know Senator Humphrey is very much intere.steel in this matter of long-range planning. And I am just trying to explore the degree to which we are able to make plans in advance for usable pro rams and make commitments to them which will enhance their acceptability by a wide community of people.

Mr. De Simone had a question also.

Mr. I)E SIMONE. Several times you spoke of new technologies. There are several agencies in Government that are involved in this and you represent the principal agencies.

Who is responsible for planning the research and development for bringing these new technologies in? How is this planning -undertaken? Dr. White referred in his testimony to an interagency committee of the Federal Council for Science and Technology. Is this undertaken them or at some other level?

Dr. WHITE. The methods of planning for various programs differs as a function of the program. But as an example, in the case of meteorological satellites, the planning is done by a joint board between NASA and NOAA called the Meteorological Satellite Program Re-. view Board. It plans the research and development effort that would be required to support the operational applications of the meteorological satellite. Other agencies have requirements for such data work with NOAA and we feed their requirements into this planning process.

In the Landsat case there is a different mechanism for doing it which is a broader interagency mechanism.

I also mentioned ocean data buoys as a technology which is emerging and there is much research and development. In that case it is done under the aegis of the Interagency Committee for Marine Science and Engineering and there does exist a plan for a data buoy system which involves the research and technology that would be required as well as 'the deployment of buoys to meet requirements of' all the agencies.

So I think it depends upon the particular kind of technology you are dealing with. The mechanisms within the executive branch are variable. But in most cases they do exist.

While I have the microphone, I would like to comment upon Congressman Brown's question with respect to continuity in the satellite program.

1 would like to comment in the meteorological satellite program, we do have continuity in the sense that it is planned through the early 1980's as an evolving system.

We know exactly how many satellites will be procured and how many will be required based upon estimated lifetimes of the satellites. So in that particular satellite situation, there is a planned continuity.

Mr. BROWN. If any of the rest of you would like to comment on any of these questions, feel free to do so.

Mr. CORDARO. Senator Humphrey asked me to follow up on some of these questions.

Some of these have to do with some excerpts we have made from Dr. Park's testimony. I would like members of the panel to comment on these.

The first one is a statement in Dr. Park's paper that says:

> Even in the U.S. Department of Agriculture there has been a minimal interest in the program and a minimum investment on the part of the Department in this technology.

Dr. Hill, would you like to comment on this?

Dr. HILL. I think you have to look at that judgment in perspective. The Department is making a substantial effort now in the LACIE program and I take it that is what the reference is about. And it has, through the remote sensing task force, given considerable attention to future needs.

My point is that careful planning is being done and that investments might flow from these.

Mr. CORDARO. Dr. Hill, there is a followup question to that.

You mentioned the SIX agencies that had cooperated within the Department on this particular program. Speculating that the LACIE experiment is successful, one could recommend that the program continue on a permanent basis. Which agencies, do you think, would have the most use for this type of information and what specific improvements would this make in those programs?

Dr. HILL. The principal agencies in the Department that we = identify now as user agencies are the Foreign Agriculture Service, the Economic Research Service, the Statistical Reporting Service, and the Agricultural Stabllization and Conservation Services. Also the Federal Crop Insurance Corporation has indicated an interest in participating m LACIE. So that would make another user agency. The Agricultural Research. Service and the Soil Conservation Service are participating in a scientific capacity.

I beg the question about where LACIE might best be done. but tile kinds of uses that it best serves are in line with some of the mission responsibilities of all of those agencies.

Mr. CORDARO. Let's take the Foreign Agricultural Service. I wonder whether under the LACIE experiment, USDA is verifying satellite information with some of the attache reports. Would that be one possibe use?

Dr. HILL. Actually I don't view that as one of the direct activities It might work out indirectly. But I would expect a LACIE-type system to produce crop estimates which would be assessed, possibly including assessment by attaches in a country as well by commodity experts in the United States.

Mr. CORDARO. I would like to ask Dr. White a question.

I know Senator Humphrey has a great deal of interest in climate and weather. At the first OTA 'hearings, we had a paper prepared by Dr. Epstein in which he mentioned the national weather program. You also mentioned this briefly. There is some question about whether the national weather program should be expanded and extended. Could you elaborate on what the implications of such a program would be and also give us some idea of what the obstacles would be in expanding that program.

Dr. White. As a bit of background, the Domestic Council requested about a year and a half ago that a study be conducted on whether it would be possible to improve our ability to anticipate climate changes and asked the question: What kind of program would you have to institute to do that? A study was conducted. A report was prepared and has been delivered to the Council and it has been released to Members of the Congress.

That report concludes: That our best scientific estimates are that we can improve our ability to anticipate climate changes. It would not be an easy job and we do not know the extent to which improvement could be brought about. And that report recommends specific things that could be done.

You asked the question, why such a program is not in motion, or what are the obstacles to putting it in motion. They are financial.

Given the present stringency of the Federal budget, and given judgments that have to be made with regard to programs that can and cannot be supported, that program came down on the other side of the priority line along with many other vital and important programs.

That would be the principal obstacle.

Mr. CORDARO. I would like to ask one more question.

Dr. Pairk, you seem to be much more optimistic about the usability of this technology today as opposed to waiting for more results.

Does that reflect your bias—the fact that you're in the business of selling the hardware--or does it perhaps reflect some of the biases or obstacles that need to be overcome in the bureaucracy, such as whether the individual agencies represented here have made recommendations to the office of Management and Budget for operationalizing the program ?

Dr. PARK. I think it is a perfectly natural question concerning the profit motive of any consultant in the business. I would be the first to say however, that I don't think there is anything basically dishonest about the profit motive.

But I confess that my principal motivation is that hating participated in the development of the technology in the Government and hopefully having contributed some small measure in spreading the benefits of the program overseas in a private capacity, I am familiar with the slings and arrows of the budget process and the defense of that process.

And I think the answer lies in two parts. One of them deals with the cost-benefit studies that have. been made and the requirement imposed upon those studies to show benefits for the technology employed in the United States and only for the United States as opposed to the world.

And the second part of that is an imposition, I believe by statute, on the restrictions that the Department of Agriculture has relative to spending money outside of the United States. That the budget put forth by the Department includes only requests for money spent domestically with possibly one exception and I believe that is the screwworm program in Mexico.

The development of technology has been a difficult one to defend as the cost-benefit guidelines have imposed rather severe restrictions on those studies.

I think the proper question is: What is the cost to the Government of not having the data rather than the relative costs of acquiring it. *

Mr. CORDARO. Thank you.

Mr. BROWN. I have just one or two more additional comments.

Dr. Park, I was impressed by the comprehensiveness of your presentation and I think it indicates a great deal of work. I haven't perused it in sufficient detail to know whether or not you have included sufficient economic data with regard to the cost of implementing the complete program that you have contemplated so that we could make a judgment as to some of the budgetary aspects of it. I hope that we can get further into it.

I think one Of the values of having someone in your position outside of a particular agency environment examine these is that you can pull together in a more comprehensive way a total program. And I think your testimony is of particular value because of that.

I wanted to just get another bit of information and understanding of the LACIE program. It is an experiment and it is moving into a phase where it will involve activities outside the United States as I understand it in the near future.

I am wondering about the foreign policy aspects of this. I note in the testimony from Dr. Abel, he quoted, I think, Dr. Hill as saying we are still not getting the cooperation from the Russians that we needed in certain areas to develop the information we needed.

Is it possible that we may encounter resistance at the international level from conducting programs which may have substantial possible implications ? Could any of you comment on that ?

Mr. MATTHEWS. Mr. Brown, I think there are two aspects of this that are important. First, in all the experience with satellite programs by and large the acceptance generally has been truly very, very positive. I think that is because their potential for doing good for everyone is so large.

Nevertheless there are occasions when this is not the case and they relate to questions of sovereignty and so forth associated with satellite observations or communications, either one.

Generally these questions have been discussed in the United Nations in working groups, but they never have really reached a situation where the have been raised to a higher level. I think this again indicates that, in general as people discuss these things, the value of them to the individual and to the individual nation is high enough to prevent a serious concern, Now, that doesn't say that as time goes on that there won% be further discussions. But if I were to guess, I certainly would say I think the value judgments would prevail over some of these concerns. I think it will also be a great benefit in more or less helping in some way, to shape and form the internationalization of these activities. We have seen this in the meteorological program and maybe Dr. White might want to comment on that.

Mr. BROWN. Well, the climatology and the meteorological areas are those areas in which we have the most international involvement.

Let me put it this way, in a more specific context. Last year in the House Agriculture Committee we had briefings with regard to the wheat crop prospects in the U.S.S.R, One set from the Department of Agriculture and another from the CIA.

The estimates from the CIA were considerably more accurate and it led to the conclusion based upon open knowledge that they have access to satellite observation data with considerable more resolution than most people have access to; and perhaps they were using data of that sort from other sources. It is possible that that might cause some problems with relation to this?

Would any of you care to comment on whether the CIA% role in making crop estimates has any sufficient bearing on the discussion we have had here?

Mr. MATTHEWS. Mr. Brown, I won't comment directly on that, but I would say that the capabilities in place *in* the civil system described by Dr. Park, and as the LACIE program now underway is indicating, and particularly with the improvements in our new sensor, we should have sufficient ability to produce the type of estimates that are needed.

Mr. BROWN. Well, I am not implying or suggesting even that the CIA already has that capability. I have no way of knowing. But I was rather interested in the relative accuracy of the crop estimates with regard to the U.S.S.R. and this is a matter of considerable policy importance to the U.S.S.R.

I would like to merely make one additional point, that the House Agriculture Committee is proposing hearings on the Department of Agriculture's research and development activities later on this month. And I, personally, as a member of that committee, feel that much of the contribution you have made here this afternoon has a great ideal of pertinence to the object of those hearings.

And I would anticipate it would be very useful from that standpoint. And we might follow up even further in connection with those hearings these aspects we have discussed here.

I have no further questions.

I would just like to conclude by expressing my very sincere appreciation and I am sure I speak for Senator Humphrey in his appreciation to you. I know you are all very busy gentlemen and I am very grateful that you have taken time to assist this Board in this matter. Thank you very much.

[Additional material submitted for the record follows:]

[The following paper was requested from Dr. Trelogan by OTA and is referred to on p. 339.]

STATEMENT OF HARRY C. TRELOGAN, ARLINGTON, VA.

AN INTEGRATED AGRICULTURAL DATA SYSTEM

SUMMARY

Two sets of developments have necessitated changes in methods of collecting farm statistics. They are technogical advances in farming and simultaneous progress in statistical technology.

Quality checks on the 1964 and 1969 Censuses of Agriculture indicated incompleteness of 8 and 17.6 percent respectively. Typically, years rather than months elapsed between the time of the collection of the data and the publication of the reports. Census data no longer meet users' needs with respect to accuracy and timeliness.

A program of sample surveys is proposed to integrate the collection of agricultural data now performed annually or more frequently by the Statistical Reporting Service of the Department of Agriculture and quinquennially by the Bureau of the Census in the Department of Commerce. The potential for gaining efficiency of estimation, economies of scale, and improved employment conditions are substantial through proper design of surveys to meet differing needs. &

Methods for probability sampling to yield greater accuracy of estimates are developed and in use for current crop and livestock estimates. They are funded for expansion into the gathering of economic data heretofore made available after serious delays by the Census of Agriculture.

A list sampling frame is being started in the SRS that will facilitate efficient probability sampling for making all farm estimates. Since 1970, improved samples have been developed for hog and cattle estimates. With these developments the stage is set for avoidance of considerable unnecessary duplication of work through an integrated system of farm data collection.

The requests for additional timely and more accurate data relating to United States food and fiber production are becoming more urgent, The burden on farmers to supply data is testing their endurance, as evidenced by resistance to answering recent census inquiries. Integration of the present systems offers opportunities for alleviating these problems with no more expenditures for data collection than are now projected.

Requisites Of Farm Statistics

Advances in farming have led inexorably to larger and more specialized units. While this has resulted in fewer and more conspicuous farming operations and seemingly easier work to estimate aggregate production, actually the job of estimating has been made more difficult and expensive because long-established earlier methods became obsolete. No longer can reliance be placed upon simply a large sample of the farms to be representative of all farms in the country. In contrast with 30 years ago, the size and specialization of farms has reached the point where one Is unlikely to gain a valid impression of the agricultural production of a county by taking a random look at a few farms. A single farm may be unique and also account for virtually all the production of particular crops or livestock in a given area. It cannot be ignored in the estimating process. Consequently, the procedure for making estimates calls for a sampling procedure that will give due weight to these large, specialized farms as well as the prevalent types.

Growth of individual farming units has also engendered demand for more accurate estimates and forecasts of farm production aggregated by counties, states, regions, and nationally. The operational units have reached such dimensions that farm families can no longer finance the kinds of equipment or the volume of supplies and services needed without resort to commercial credit. Both the farm management and creditors require reliable information on existing and prospective supplies of farm produce before making the investments or assuming the risks of putting together a viable farming operation in today's agriculture in the United States.

Added to this demand for dependable statistics is that of manifold businesses supplying or servicing farms that must keep tab on farm production to intelligently plan their operations. Assuming greater importance in recent years are the needs of national and international planners and diplomats for protecting large populations now dependent upon United States food supplies.

Higher quality statistics are now required. The quality features most needed are: (1) accuracy and dependability; (2) timeliness in terms of frequency of reports, short time intervals between surveys, and promptness in getting out results of surveys; and (3) adequacy in terms of sufficient detail to meet the purposes, The latter requirement usually refers to geographical detail, number of items or species reported, and indications of quality of products. Almost invariably greater expense is incurred to obtain improvement in any of these quality factors.

Steps Taken to Meet Requirement

Confronted with shortcomings in bases for sampling and more demanding requirements for frequent, detailed, and especially accurate data, the U.S. Department of Agriculture (USDA) has devised feasible means for getting the information. The first step is to collect authentic data from farms quickly and in a form that can be readily transformed into estimates and forecasts useful to economic analysts and business operators, including farmers.

Fortunately, the theory and practice of statistics has advanced along with farming, so the problem is largely one of adapting new tools to the job. As with farming, these new tools are far more expensive than the old tools. This is especially true of the current estimates of production made by the Statistical Reporting Service (SRS), where the notoriously inexpensive mail questionnaire system had ***been*** perfected for over 100 years. [1] It performed well in this country, where we had the advantages of a literate farmer population willing to give the Government information, and so long as we had an inexpensive, reliable rural mail service and a dependable five-year Census of Agriculture to periodically true-up current estimates.

The inadequacy of the old tools came to public attention following a 10 percent error in the cotton production estimate for 1952. Through research for new methods, instigated by this incident and directed by the House Agriculture Appropriations Subcommittee, a probability sample was designed to replace the previous system. Over a period of 14 years, an area probability sample was put into operation in the 48 contiguous states.[1]

The probability sampling method was initially adopted in the form of an area sample based upon a complete sampling frame for the 48 conterminous states. [2] [3] It was designed to provide national estimates annually with a 2 percent standard error and has replaced the role of the Census of Agriculture in providing benchmarks.

Implementation of area probability sampling for the entire country laid the cornerstone for restructuring the entire agricultural data system. This new foundation, replacing the Census of Agriculture as the underpinning for crop and livestock estimates by providing annual benchmarks. occurred none too soon. It, being the only complete sampling frame available for American agriculture, is useful for backstopping other parts of an agricultural statistical program.

Census Difficulties

The rapidity of change in farming had rendered the Census of Agriculture obsolete. Typically, from three to seven years elapsed from the time an annual estimate was made before a new benchmark was available for comparison. In view of the fact that the number of farms raising dairy cattle, for instance, dropped 40 percent between the 1954 and 1959 Censuses of Agriculture, the old system would no longer suffice. Changes of similar magnitude have occurred repeatedly, necessitating faster methods for getting such basic data as the number of farms, land in cultivation, acreages of major crops, and livestock inventories. These data furnish the undergirding for estimates and forecasts month by month throughout the year.

As farms became larger, requiring huge investments, the structure of ownership changed to accumulate enough capital. Many farms integrated horizontally, causing the farm operations to be done as separated tracts sometimes transcending political boundaries. [12] They also integrated vertically, with marketing firms supplying factors of production ***or*** processing ***or*** distributing the farm output. As these developments occurred, the concept of a Census of Agriculture as originally

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[1] Eight years of research and pilot operations preceded the initiation of enumerative surveys to collect these data in 11 southern and 4 Midwestern states in 1961. Thereafter, it was spread across the country as follows : 1962, 5 additional states; 1963, 4 states ; 1964, 8 states; 1965, 4 states ; 1966, 5 states ; and 1967, 7 states. New appropriations for the 48 states totalled $4,137,000.

Conceived-i. e., **a full** count of independently owned family farms became an anachronism.

Furthermore, the method of collection, using temporarily recruited canvassers for a few weeks once every live years, became impractical. Qualified interviewers became more difficult to find at the low rates paid, and the job become more difficult, involving more personal and intricate information about the ownership relationships and sources of capital. To overcome some of these troubles, the Bureau of Census began to collect the Census of Agriculture by mail.

Then they were confronted with two other major problems. One was to get a satisfactory mailing list of the farms, This has never been adequately solved, judging from the incompleteness of coverage that has evidently been growing in successive censuses.

A quality check made by carefully and thoroughly recanvassing a subsample of farms following the 1964 Census indicated 8 percent incompleteness. The quality check for the 1969 Census made from data collected in the SRS enumerative surveys using the area sampling frame showed 17.6 percent incompleteness. [4] This check method, by the way, was far less expensive, much more effective, and added no burden to farm correspondents. a

With incompleteness of the magnitudes experienced, the Census took on the characteristics of a large but uncontrolled sample. As such, its accuracy could not be measured with statistical precision. The sampling method adopted for the 1969 Census of taking one half of the small farms, construed to be those producing less than $2,500 of sales, also suffered from being an uncontrolled sample. These circumstances dictated considerable adjustment before crop estimators could use the data. The problem *was* particularly onerous in the case of livestock because the surveys are taken for different seasons of the year, and in the case of cattle, for instance, the 1969 estimated incompleteness was 8.5 million head located on 298,000 farms. [4]

These limitations pertain also to economic data obtained by the Census of Agriculture. For 1974 the census definition of a farm has been changed, so that results will probably be reported with less coverage. [5] As we will see later, a shift to SRS for use of the probability sampling frames to acquire economic data is well underway.

The circumstances suggest that to continue taking a Census of Agriculture on the present pattern is a waste of time, effort, and money.

Quest for Greater Accuracy at Less Cost

Before the new area probability sampling became fully operative in the SRS, it became evident that the goal of a 2 percent standard error would not be adequate. The results of the 1964 Census of Agriculture did not become available to the Department of Agriculture for making revisions in its livestock estimates until February 1967. Total cattle estimates had to be revised upward by 2 percent to make the two series consistent. The revisions caused an uproar from cattlemen, who pointed out that they had been misled into raising more cattle during the years since 1959 when the estimating error was accumulating. Price analysts judging from current estimates of cattle inventories and market news slaughter data had concluded that the cattle cycle had turned downward and advised farmers that the price prospects were very favorable. As a consequence of the revision, the price outlook was reversed, causing financial disaster for some and consternation among growers generally.

Two conclusions drawn from this experience were: (1) The area probability sample was more efficient for estimating crops than for livestock; and (2) The former goal of achieving a 2 percent standard error would no longer suffice. To meet these problems, it was further concluded that the area sample needed to be bolstered by less costly methods than simply expanding the existing sample, the usual method for gaining accuracy.

A new method was devised by SRS based on theoretical research by Professor H. O. Hartley of Texas A&M University, which indicated how results from two sampling frames could be embodied into a single probability estimate. This opened a new way for SRS to take advantage of the less expensive mail survey to acquire additional data to bolster the estimates.[2] The major requirement to achieve the attributes of a probability sample was that the samples canvassed

[2] To gain the advantage of an expanded probability sample without incurring the very high costs of sending enumerators out to find the farms as In the area samples, the SRS adopted a multi frame system for different kinds of estimates. It consisted of the area frame, a probability list frame, and old mailing lists. The latter were used primarily for state estimates.

by mail be drawn from a list of all the farms growing the products being estimated in the state or nation. Associated with the names and addresses, sufficient control information is needed to draw stratified samples. The farms in each stratum have predetermined probabilities of being selected according to known characteristics such as approximate size. The control data, therefore, include, in addition to location, the farm enterprises and some indication of the size of each. [6]

Search for Lists

inquiring into the possibilities of developing a suitable list led the SRS to seek cooperation with the Bureau of the Census because it was obvious that a similar list would be needed by them if the Census of Agriculture were to be taken by mail. Furthermore, it was apparent that the compilation and maintenance of such a list for the United States would be expensive-on the order of $5 million a year. An early conclusion was that the public would not likely countenance two agencies of the Government incurring the expense and bothering the farmers to maintain independent lists. The best starting point for this pioneering effort, which was going to involve the combining of lists from many sources, was to get the list of taxpayers reporting income from farming to the Internal Revenue Service (IRS). Inasmuch as the Bureau of the Census already had access to this source, cooperation with the Bureau appeared promising, and SRS was encouraged by the Bureau that it might be worked out, *although some* hurdles had to be overcome. One of these involved SRS getting approval to use IRS lists, since the permission granted to the Census Bureau did not extend to the SRS.

The procedure was to get a Presidential order granting access to the lists. After three years of negotiation, President Nixon issued such an order with the White House determining the timing and the manner for publication of the order. When the announcement was made, a furor ensued, resulting in congressional hearings at which SRS was advised that $5 million was not to be regarded as too high a cost to preserve the privacy of IRS records from another government agency for statistical purposes. Other means had to be found for SRS to begin its compilation of suitable lists.

Presumably, the list compiled for the previous census might serve as a starting point. The Census Bureau ruled out this source for SRS, pointing out that under law it was not allowed to reveal such information. Since SRS had the same restrictions imposed by regulation and since both agencies would benefit from combining their lists, it was believed that *a* single farm register could be contributed to and be used by both agencies. Several years of efforts were unsuccessful in getting the Bureau of Census to contribute to such an arrangement.. Meanwhile, the viability of the census lists was deteriorating, being at least five years out of date.

During this hiatus the SRS was conducting research on how to compile lists useful for the purpose. As appropriations were made available, SRS began in 1970 to introduce the use of these on a limited scale, notably in estimating hogs (ultimately in 23 states) and cattle (in 38 states).[3] The experience with livestock clearly demonstrated the practicability of the method and that substantial improvement in accuracy could be achieved. Both the research and the experience support the belief that the most effective approach will be to compile list frames on a state-by-state basis because useful sources of names vary so much between States. Depending upon provisions for state farm censuses, the incidence of different regulations such as brand registrations, the locations of markets with available records, and numerous other circumstance% the jobs are quite different from state to state.

Conversely, no national source of names has been identified that will yield a list consistently by states that has the necessary attributes of being clean, current, and complete. To be clean, a name must appear *once* and only once as the authentic source of information about a farm operation. To be current, the information on ownership should be authentic for the current *year,* and to be complete, all farm enterprises should be included. Unfortunately, the largest known lists compiled by the Agriculture Stabilization and Conservation Service are deficient in all of these qualities and are inconsistent by states.

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[3] Hogs and pigs estimated from multiframe samples were introduced in five states in 1970 : five additional states in 1971 : four states in 1973; and nine states in 1975. The 23 states cover 96 percent of the hog population. Coincidentally, the cattle multiframe samples were introduced in 38 states covering 96 percent of the population. $2,646,900 is the present appropriation for these livestock estimates.

Consequently, the SRS asked Congress for appropriations to compile and maintain general purpose farm lists, as is done on a restricted scale for livestock estimating. In the budget for 1975, SRS was granted an appropriation of $1,225,000 to begin compiling the names for a general purpose list frame suitable for multiframe probability sampling. When this job is completed, the SRS will be in position to reduce the standard error for national estimates for major crop and livestock species to 1 percent.

More importantly from the standpoint of this discussion, it will also be in position to obtain through sampling methods almost any kind of data needed from farms in the United States

Prospects for Additional Data Collection

A headstart has already been made toward the acquisition of economic statistics now needed by the Government and the economy on a more current basis. Three years ago the SRS started a transition to the annual collection of data on farm expenditures for updating the weights used to compare the indexes of prices received and prices paid by farmers. Heretofore the data were collected in large national surveys intended to be taken about every ten years. [71 Owing to the large appropriations needed when they were scheduled, they were actually taken less frequently, to the detriment of the indexes. It is anticipated that the collection of these annual data may be coordinated with other economic data collected especially if data are collected on a regularly scheduled basis. The collection of such data is in prospect for the immediate future.

For many years SRS has collected economic information from farmers for the Economic Research Service. Much of this has been done annually with little or no compensation by adding questions to mail questionnaire surveys scheduled in regular crop-reporting program Closer public scrutiny of economic analyses and an accompanying demand for greater accuracy caused the Office of Management and Budget (OMB) to rule that data collected for them be put on a more acceptable statistical footing. Consequently, SRS has adapted probability sampling methods and expanded the scope of data collected to accommodate these requirements with ERS financing the added costs.

SRS likewise has been called u n to supply farm data for nine other agencies in the Department of Agriculture and seven federal agencies outside the Department of Agriculture in the last five years.[4] These special requests for data usually involve economic data such as utilization of factors of production and costs. In fiscal year 1975, for example, SRS received $&2 million for these services for other agencies that needed current data, promptly reported. Two-thirds of these data were obtained by utilizing the area probability sampling frame.

In 1965 ERS was directed by Congress to analyze costs of production for cotton. Collection of data for this and related studies was done by SRS. This turned out to be the forerunner of similar studies in subsequent years. In 1974 and 1975 there has been a veritable eruption of needs for more current data on farm costs and income. They have been instigated by several developments, among them the imposition of price ceilings on farm products, revelation of - defects in farm income estimates, and efforts to obtain better agricultural income and expenditure statistics for use in the national economic accounts-a very demanding system that has been developed in the Department of Commerce under the guidance of the OMB and the Council of Economic Advisors.

To help meet the needs for additional and more accurate current economic data, the ERS was given $1,330.000 to make an annual economic survey in addition to farm cost analyses. In 1975 ERS was (appropriated $670,000 for wheat, feed grains, and dairy costs studies that were called for by the Agriculture and Consumer Production Act of 1973. It is anticipated that about $1.9 million will be transferred to SRS to collect the data for these studies beginning next year. Multiframe probability sampling surveys will be employed for the purpose. Thus, SRS will be coordinating data collection surveys for several different purposes that in years gone by might have been done with census data but that now require up-to-date information from a fast-changing agricultural economy. The ability and willingness of SRS to collect these data closely related to census data is clearly demonstrated,

Respondent Fatigue

The proliferating demands for farm data causing repeated surveys of farmers to supply them is taxing the patience and ability of farm respondents. Opera-

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[4] GAO, NASA, AID, Departments of Commerce, Interior, Labor, and HUD.

tors of sufficient size and scope to be included in every sample usually have well-organized management records and professional accountants or bookkeepers to facilitate their response. Their burden can be weighed against the public's right to know of operations that significantly affect the food or fiber supply of the state or nation. It can be regarded as one of the costs of being big in our society. Less influential and specialized operators find the burden not only onerous but more difficult to respond to, even though they may not be included in every sample.

Respondent fatigue has been particularly noticeable in recent censuses as resistance to reporting has grown. One can better understand this reaction if he realizes that a small farmer is likely to receive a form containing about 200 questions to which he has to react in an intelligent manner, ascertaining which questions apply in his case and giving the information. He is reminded that the law requires his response. The large farmer is apt to receive in the mail, with some 750 questions, a form designed for him to fill out and return as required by law. [8]

Incompleteness of returns experienced in taking the Census of Agriculture is partially attributable to deliberate refusals to reply and partially to inability to contact the farm operators.

In the effort to reduce the latter problem, many more census forms were sent out than there were people farming. For the 1974 census, 4.2 million questionnaire forms were mailed out. This compares with 2.7 million farms counted in the previous census. Nevertheless, it appears probable that a substantial incompleteness will occur again. Inasmuch as efforts are still underway to get 1974-census returns, it is premature to judge the amount of the shortfall.

A proposal to alleviate problems of lack of contact and reduce overkill in mail-outs is to conduct a precensus canvass to locate farmers and to obtain preliminary information regarding their size and types of enterprises. This will compound the fatigue problems, but it is hoped that the subsequent distribution of the most appropriate questionnaire forms would be offsetting.

An important secondary benefit sought in sampling schemes adopted by SRS was a reduction in the number of reports needed to get adequate data for estimating national and state totals. With judicious use of control information, the number of farms that need to be contacted are reduced on the order of 75 percent compared with former methods for obtaining the same information. Offsetting this advantage in part is the fact that it is necessary to get data by telephone or personal visits when a respondent fails to reply to mail inquiries. The most promising means to minimize respondent fatigue and still meet the rising demands for data is to coordinate all the farm data requirements into a single system of surveys, thereby reducing both contacts and duplication.

Other Deficiencies Needing Attention

A farm data collection system will need to be reasonably flexible to adjust for the correction of some other arising problems. For about five years the American Farm Economic Association has called for a reconceptualization of the relationship of farms to the economic structure. The principal impetus is to obtain better guidance on what data to collect in anticipation of how they are to be used for analysis and decision making. As progress is made in updating the theoretical framework, it is to be expected that changes will he needed in counting and measuring farms and related phenomena.

One of the more important reasons for this will be to fulfill the needs of the national accounts system, which is preempting the economic statistical field. This relatively recent development concentrated first on other parts of the economy, adapting the agricultural data that were available to its needs. Now that the national accounts system is becoming more sophisticated and precise, it is calling for changes in the agricultural data inputs, necessitating more precise data applying to shorter time periods. The agricultural statistics system will be expected to accommodate these needs. An integrated system able to collect data at appropriate times is most likely to do so.

Similar needs for data at particular times to compare with data from other censuses and other sources are also likely to occur. The Census of Agriculture has always been taken quite independently of other censuses, except at 10-year intervals when the time of data collection is near to that for the population census. Otherwise, the concepts, timing, and administration of the farm census are quite separate and apart.

A problem may arise from the fact that in the origination and 100-year growth of the crop and livestock estimates, the main focus of attention has been on facilitating decision making in the private sector. Crop and livestock estimating is unique in that regard among public statistical services. The national accounts have been tailored more to aid public policy makers and Government administrators. To meld data collection for these diversely motivated systems calls for considerable reconciliation. [9] This problem was in the minds of the Agricultural Economists' Committee, which had faith that new concepts could contribute toward that end. They, more than the general economists and statisticians, are conscious of the vital role federal agricultural statistical services have played in guiding the myriads of independent business decisions affecting our food and fiber supplies. The statistics have exercised the strongest cohesive force in the agricultural economy because they provide a common fund of reliable information on which all segments of American agriculture depends. Society can ill afford to reduce their effectiveness if a competitive economy is to be preserved.

The OMB, sensing some of, these problems, began calling for a study of the entire agricultural statistical complex in 1968. Under an OMB directive, the USDA requested in the SRS budget for that fiscal year $50,000 to finance the inquiry. The request was denied by Congress, but the idea arises in one form or another periodically, usually provoked when additional funds are requested to institute new methods. It is being advocated again at the present time, but plans as yet have not clearly indicated how it is to be financed and performed.

SRS has recognized a need for reconciliation of differing objectives in determining the content and timing of farm data collection. It awaits directions from OMB or some responsible source for overall policy guidance. Meanwhile, it has proposed piecemeal improvements and solicits users' reactions. Acceptable proposals are adopted, Two events give evidence that OMB has institutional goals uppermost in mind.

The proposed "Department Reorganization Plan" announced by President Nixon in 1971 "called for concentrating the major statistical agencies of the Departments of Agriculture, Commerce, and Labor in one principal subdivision of the proposed Department of Economic Affairs." [10] In essence, this centralized statistics agency would be divided into two main functional units—a unified data and planning office, and a centralized, service-oriented data collection and processing center. A reorganization plan was instituted in existing departments by the OMB so that the work organizations would be prepared for ready transfer to the Department of Economic Affairs when the Departmental Reorganization Plan was approved by Congress, which did not occur.

USDA had very little adjustment to make internally to adhere to the OMB guidelines because it had for many years maintained a segregation between SRS, mainly in collection and processing activities, and ERS, engaged primarily in economic analysis. Presumably, placing the work of these agencies into a single agency, which also contained the Bureau of the Census, would circumvent the legal and regulatory requirements preventing the agencies from sharing data. It may be noted that placing the Census of Agriculture and SRS data collection activities together into one agency oriented to concentrate on agricultural statistics is quite consistent with this idea, but it avoids complete centralization of all federal statistical services. SRS has already amply demonstrated its posture of service for other agencies concerned with analytical and administrative work, so the arrangement is not entirely novel.

Nevertheless, from the standpoint of implementing a single agriculturally-oriented statistical unit, the OMB itself becomes a problem. The standard answer is that they want a thorough inquiry into farm statistical services.

The second event, initiated by OMB in furtherance of their objectives, was establishment of a unified statistical budget for tile Government. Departments were directed to submit to the Office of Statistical Policy (OSP) of OMB their proposed budget requests for statistical activities. This office then proceeded to amend the amounts that could be requested, specifying increases or cuts by agency and activity for the stated purpose of improving federal statistics. In the first year of operation of the unified statistical budget, OSP claimed responsibility for a 16 percent increase in the statistical budget as a whole. The Department of Agriculture, however, was told to curtail its statistical budget request by $1 million, later reduced to $750,000. Evidently, the authorizations taken from the USDA's requests were distributed to other agencies. Two years later when the Administration and the public were concerned about what was going to happen to food prices, the Council of Economic Advisors launched an inquiry into the lack of ability of ERS to forecast these prices during the months and years ahead. The inquiry, by an outside scholar, cited the relationships between budget allowances and the capabilities to do such work, pointing out the status given earlier to agricultural statistical priorities. [11]

The desirability of a closer affinity between the farm census and the economic censuses, especially in terms of the concept of business units, was advocated by American Farm Economic Association's Committee and called to the attention of OSP. The response was the proposal that the Census of Agriculture be postponed and be taken at the same time as the Census of Manufacturers and other economic censuses. This hardly dealt with the crux of the matter, but an integrated system would be more able to accomplish the timing of farm data collection to coincide with such needs than is the case at present. The Census Bureau is asking for legislation to place them together in 1982 for the first time. For years ending in "O" some state or national data wanted in conjunction with the Census of Population could be added in an integrated program.

Potential for Satellite Data

Before examining alternative means for acquiring farm data, we take a moment to examine a source of data looming prominently on the horizon. Perhaps the most frequently mentioned contribution of the Landsat (formerly ERTS) satellite to civilian needs is information relating to food supplies, usually involving crop acreages and yields. Although considerable money is being spent— such as the Large Area Crop Inventory Experiment (LACIE)—to demonstrate the possibilities, they must still be regarded as potentially possible. Crude information about the earth's resource inventories and kind uses is probably within grasp, but many existing claims for detailed information are still to be classed with unfinished research.

Evidently, the most practical ***use of the*** satellite for crop estimates with the present state of the art is to make sampling more efficient. By relating information from the satellite to ground truth, a computer can be trained to stratify land for the purpose of improving the efficiency of collecting agricultural statistical samples.

Up to now, efforts to gain information on crop acreages and yields directly from satellite data, by-passing the use of ground truth, have been fruitless. The possibility sounds dramatic and exciting and has captured the imagination, but it has also diverted attention away from practical ways of combining the two sources of data to yield better results, The great desire for gaining intelligence on crops without dependence upon information from those who own, control, and till the soil is so great in international affairs today that it has led scientists to exert strenuous efforts to find ways for the satellite to give the answers. Hardware salesmen have fostered these efforts. But desire, no matter how intense, and ***money,*** no matter how much, do not in themselves create the means.

No practical way has yet been devised to measure crop acreages by species, to estimate yields, or to count livestock in the absence of ground truth information to check satellite data. Without current data, estimates are likely to be so far off as to be misleading for planning purposes.

Crop yields are of course affected by weather, but the measurement or prediction of yields from only weather data collected by satellite is hazardous, except for gross changes leading to disasters such as major droughts, floods, or freezes. The combinations of moisture and temperature during stages of plant growth are so varied in intensity and duration that these data alone cannot be relied upon to predict yields within reasonably useful ranges of precision. Actually, the measurement or prediction of crop yields from weather data obtained on the ground has never proved reliable in practice for crop estimating.

SRS research indicates means by which satellite data can be useful to improve the efficiency of sampling to obtain more accurate crop estimates. This preliminary research has indicated that gains of up to 50 percent are possible. The research suggests that the coefficient of variation or the standard error can be reduced on the order of one half from their present size based on ground survey data alone. Current satellite imagery, matched with samples of simultaneous ground truth such as is obtained regularly by SRS enumerative surveys, gives correlations between crop identifications from the two sources that can be applied to vastly larger areas supplied by satellite imagery. This method for improving reliability of an estimate has yet to be proved in an operating mode. If it works out, a smaller number of samples may suffice for probability surveys.

Some ***Questions Posed and*** Answers Suggested

Any rationale for continuing the Census of Agriculture is that it will perform different functions than other statistical services. Three functions that the census has performed uniquely among statistical services are: (1) It has supplied demographic data about the farm population, especially in those years ending in "5" when the population census was not taken; (2) It has supplied economic data about farms not included in the current estimates programs; (3) It has supplied county data that can be aggregated into relatively small areas; i.e., areas smaller than states; (4) One variant of this, other than geographic, is that it supplied data in much greater detail than surveys for current estimates. Each of these is discussed in turn below.

(1) At best, demographic data regarding the farm population obtained by the Census of Agriculture was a by-product intended to fill a void. Its capacity for doing this is now seriously circumscribed because of the radical changes that have occurred in the farm structure which has largely separated farm management and ownership from farm residence. [12]

The well-being of farm households could once be measured with data indicating the prosperity of farm enterprises, but correspondence between them has diminished to the point where it is no longer practical to continue such statistical concepts.[6] Farm income data derived from tax sources reveal the degree of noncorrespondence when they show that only 7 percent of the families living on farms in 1971 relied solely on farm self-employment income for family living. Of those relying solely on farm self-employment income, 14 percent resided off the farm; and 31 percent of families residing on farms reported no farm self-employment income. [13] [14] These circumstances suggest that the Census of Population, possibly augmented by current population surveys and by tax data, will be the source of farm demographic data in the future. [121

(2) Economic data, besides crop and livestock estimates, can be obtained from probability samples, as the SRS has amply demonstrated through the extensive use of the sampling frames for the purpose.

(3) The main difference in acquiring county farm data as contrasted with state and national data is the size of the sample, which will also be influenced by the degree of accuracy sought. In order to attain an accuracy level comparable with that obtained with the incomplete counts of the census, a well-designed 25 percent sample will probably do.

(4) The size of survey designed to acquire county data can be expanded in terms of questions asked as well as in sample number sufficient to get the additional detail wanted. Some detail now included in the census would not be necessary, since surveys taken at other times to give state and national estimates would not need to be repeated in county surveys.

An aspect of this fourth item is that the census provided much detail useful for research. This is true especially for studies over time revealing trends, and no doubt regular surveys of all types are a productive source of data for research. But researchers emphasize that profile studies probing economic relationships in depth for inquisition of knowledge require microdata with much more detail and precision than is supplied for applications of knowledge through regular statistical services. [16] In fact, the characteristics of data needed for such research calls for special surveys specifically designed for each research project, [16] For agriculture most of these types of surveys are conducted by researchers in land grant universities. Occasionally, data are collected specially for research studies as an adjunct to a regular SRS survey.

These exceptions notwithstanding, census data have been particularly useful for research analysts who could relate the data to other economic phenomena and could trace the data back through previous Censuses of Agriculture to identify and measure long-term trend changes. This advantage is held in low regard by the Department of Commerce, which proposed to arbitrarily break the series of data by postponing scheduled censuses.

Purveyors, manufacturers, and producers of farm equipment, supplies, and services also used the censuses to get detailed purchase, usage, and farm practice data indicative of the market for their products. The Censuses of Agriculture had more requests for these kinds of data, useful to private industry—for example, sales managers devising sales schemes--than it could accommodate given the limits imposed *by* respondent fatigue in filling out questionnaires. An integrated system could furnish these same kinds of data, subject to the same limitations.

Cooperation with State 0ffices

One big advantage accruing to the SRS system for collecting farm data is derived from the use of 44 permanent state offices to decentralize the work of conducting inquiries and processing results for all states. In connection with the operation of these offices for current data programs, cooperation with state agencies is established in 48 states to obtain additional *or* more detailed farm data needed for state programs. Through these voluntary arrangements, state and federal agencies benefit (1) from cost savings by collecting the data for their respective needs at the same time : (2) from reduced respondent burden by collecting their data together, thus avoiding repetitive inquiries; and (3) from assurance of compatible results so that reports issued by the two sets of agencies are consistent with each other.

Unified support received from federal and state officials in urging farmer cooperation is also a boon. Data collected to satisfy state needs are often valuable as check data that would not otherwise be available. Working together improves understanding of the statistical programs and promotes fuller use of data for carrying out the respective public responsibilities as well as by private industry.

But of much greater significance for operating sample surveys, where extreme care must be exercised to make sure all counts and measurements are recorded accrately, is the better opportunity to clear up inconsistencies uncovered by editing of schedules. Located closer to enumerators or respondents who originate the data, inevitable mistakes owing to misunderstanding of questions or other errors can be corrected more easily and promptly.

Probability sampling requires more voluntary cooperation from respondents than the older mail surveys, in the sense that the data has to be obtained from the persons or places selected, whereas before, replies coming from only those willing to reply quickly and regularly were used. Local enumerators plus state and federal officials working together are better able to elicit the cooperation and get the information straight.

This mutually beneficial state-federal system of data collection is already in place and has demonstrated its superiority. It has the capacity for expansion to also collect data for the clientele usually served by the census. The total job could be done much more expeditiously if the inquiries were spread out over a five-year period rather than all collected in one fell swoop every live years. This is true for a number of reasons, of which several will be briefly cited.

Fitting Samples to Quality Requirement

All farm data does not have to be collected in the same detail or with the same standards of quality. Some data are needed only on national bases, some only for state estimates. and still others on localized or county bases. In general, the greater the aggregation of data, the smaller the samples needed to achieve a given accuracy standard. Exceeding the quality necessary is a waste of money. Over a five-year period agricultural statistical surveys could be classified by quality requirements and scheduled by years accordingly. Where national data will suffice, surveys may be scheduled in given years, for state data surveys. other years will be used, and only once every five years will it be necessary to increase the size of sample to produce county data. Exceptions could be made for those states and for those items for which particular state or federal agencies are willing to bear the extra costs. It is likely that the county data would be collected for *years* ending in "2" and "7" to facilitate *comparisons* with economic censuses for the same years.

Through this type of scheduling all needed farm data could be collected over each five-year period with the accuracy, frequency, and detail of items and geographical coverage fitted to needs. Drawing of samples to spread out the reporting load among respondents or to minimize *the chances of* one respondent being included in every survey may be arranged. The work of enumeration processing, and publishing could also he spread out among years and within years to reduce the peaking of workloads. With prospects of steady work more experienced employees may be attracted. for whom more training can be afforded.

Data collection for current surveys could be made to coincide with some collection made for longer term needs. Probability samples would be designed to yield standard errors adjusted to the needs of each survey, and data collected in one could be designed to supplement and reinforce the other. This principal is now practiced in crop estimating: for example, planted acreages of' crops are estimated only once for the year. When subsequent monthly surveys.

of crop yields are made, a small subsample of acreages is checked to see whether adjustments are needed in acreage estimates.

***Possible Cost* Savings**

Assuming an integrated system of the type described, opportunities for cost savings include:

Reducing the number of times individual farms need to be contacted to collect data ;

Reducing the size of questionnaires or length of interviews for farm data collection by at least 25 percent—more for items needing only national or state estimates;

Eliminating the need for two agencies to compile and maintain lists of farmers in the United States identified by size groups, enterprises, and locations;

Eliminating the printing and distribution of a million census forms that are not used;

Eliminating the need for a precensus canvass in the effort to identify farms and verify control data;

Incorporating newly required data into an operating sampling scheme in less time and at less cost;

Utilizing satellite data more quickly to improve the accuracy of sample estimation. With success, this may be translated into smaller, less expensive samples to get the same accuracy;

—Savings to the economy from greater accuracy. [17]

Savings involving appropriated funds will be offset in part by increased funds needed to complete the compilation of a list sampling frame started in SRS. An additional $3 million is required to make it operational for an integrated program.

Estimated Cost

The main elements of the agricultural data system with which we are concerned are: $9.1 million for the Census of Agriculture and $28.5 million for the crop and livestock estimates, or a total of $37.6 million annually.

The projected cost for an integrated program giving higher quality statistics covering the same ground in a typical future year is $36 million.

These estimates make allowance for the cost increases and decreases discussed, except that they exclude statistics collected for state agencies and for other federal agencies. They also exclude statistical research and clearance activities presently assigned to SRS but not a part of the crop and livestock estimates. None of these exclusions bear on the budget or appropriations for the integrated services. None of these estimates make provisions for inflationary Costs.

Administrative Alternatives

Administration of an integrated system may be arranged in any of several alternative ways, as the discussion has suggested. One would be through a general reorganization of government statistical services to accumulate most or all of them in a single administrative unit. An expressed hope of the American Statistical Association and also of blue ribbon committees with a statistical orientation has involved a change of this character, with the head of the statistical work reporting directly to the President. [18] A strong advantage would be to get ***more*** balance and uniform quality in statistics throughout the Government. A disadvantage would be the separation of statistics from the programs they support; or rather, conversely, the support of statistics from the program administrators, usually Cabinet officers, and their budgets. This proposal, of particular concern in the case of agriculture, was denied along with most ***of*** the Governmental Reorganization Plan of 1971.

Another possibility akin to the first would give the Department of Commerce responsibility for the collection of current agricultural statistics along with the Census of Agriculture. A change in this direction would favor a continuation of the Census of Agriculture in its present form, but with years for collection altered to eventually coincide with the economic censuses.

A third possibility, a reversal of the second, would place the integrated system in the Department of Agriculture. This arrangement would be appropos if the objective to convert the census to a sampling approach is adopted.

Every one of these alternatives would require legislative changes and would involve the transfer of legislative and budgetary responsibility among congressional committees. Administrative responsibilities and appropriations would accordingly be transferred between Cabinet officers pursuant to the legislation. Agricultural statistics have fared well with legislative committees and administrative leadership interested in agricultural policy and have gained professional respect for technical preeminence unequaled at any time or place.

Conclusion

Given the changes in agriculture and in methods of collection adopted by the Census, it makes no *sense* to continue the Census of Agriculture. The Statistical Reporting Service, facing the same problems of technological change, has taken positive steps to solve them, thereby increasing the integrity of its public service and reducing the need for the census by presenting a more viable alternative for acquiring needed data. Thus the time has come to halt pandering with farm statistics by assuring that only data released in time to be useful is collected through an integrated system.

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TABLE 5.—CHARACTERISTICS OF FARMS MISSED IN THE CENSUS BY CLASS

	All farms	Farms sales of—									
		Class 1-5—$2,500 and over	Class 1—$40,000 and over	Class 2—$20,000 to $39,999	Class 3—$10,000 to $19,999	Class 4—$5,000 to $9,999	Class 5—$2,500 to $4,999	Class 6-8—Under to $2,500	Class 6	Class 7—Part-time farms	Class 8—Part-retirement farms
Number of missed farms	252,751	37,973	1,607	2,496	4,350	9,837	19,683	214,778	53,548	99,948	61,282
Land in farms	24,928,805	12,078,990	1,595,745	1,188,573	2,621,058	1,402,050	5,271,564	12,849,815	4,038,305	4,817,732	3,993,778
Average size of farm	98	318	992	476	602	142	267	59	75	48	65
Corn for grain:											
Farms	50,903	10,880	485	1,133	1,478	3,791	3,993	40,023	11,534	18,006	10,483
Acres	507,437	268,705	6,439	66,996	66,480	83,638	45,152	238,732	84,150	83,900	70,682
Sorghums for grain:											
Farms	2,219	1,014			277	624	113	1,205	347		858
Acres	121,845	118,670			33,794	81,712	3,164	3,175	601		2,574
Wheat:											
Farms	3,584	1,977		82	574	869	452	1,607	112	1,089	406
Acres	142,645	135,915		2,544	73,831	45,458	14,082	6,730	224	5,142	1,364
Soybeans:											
Farms	12,695	5,054	155	521	487	2,421	1,470	7,641	2,149	3,525	1,967
Acres	438,405	367,300	137,540	76,862	41,923	68,299	42,676	71,105	27,029	29,067	15,009
Hay:											
Farms	53,463	9,074	377	783	1,740	2,182	2,894	44,389	10,591	20,782	13,016
Acres	673,845	205,152	7,560	25,210	59,911	36,232	76,239	468,693	147,408	194,131	127,154
Cotton:											
Farms	11,028	3,496	137	202	390	1,925	842	7,532	3,401	2,173	1,958
Acres	285,847	235,431	109,600	30,829	21,751	59,742	13,509	50,416	26,725	15,415	8,276
Tobacco:											
Farms	33,535	12,397	18	707	1,461	4,859	5,352	21,138	5,914	9,502	5,722
Acres[1]	70,205	55,049	684	6,240	11,515	22,244	14,366	15,148	3,955	7,426	3,767
Cattle and calves:											
Farms	163,800	23,465	1,167	1,304	3,236	4,422	13,336	140,335	36,398	64,447	39,490
Number	2,631,685	1,230,559	230,162	94,633	251,862	124,829	529,073	1,401,126	407,844	588,805	404,477
Hogs and pigs:											
Farms	79,016	11,765	306	770	1,386	4,082	5,221	67,251	20,506	29,307	17,438
Number	1,068,399	470,481	8,172	98,560	59,222	176,512	128,015	597,918	194,304	274,769	128,845
Hens and pullets:											
Farms	83,027	11,347	179	868	940	2,460	6,900	71,680	19,683	30,256	21,741
Number	9,260,796	7,534,054	6,802	5,743,305	16,659	104,350	1,662,944	1,726,742	481,797	660,469	584,476
Total value of products sold:											
Farms	238,890	37,973	1,607	2,496	4,350	9,837	19,683	200,917	50,954	91,896	58,067
Dollars (1,000)[1]	480,424	335,573	80,680	65,475	56,541	64,984	67,882	144,842	51,212	55,956	37,660

WEST ;

Number of missed farm$-----	50,142	13,460	1,011	1,030	2, 2io	3,551	5,658	36,682	5,546	25,193	5,943
Land in farms -------------	10, 544,;;;	7,492,221	1 , 6 2 0	2,159,761	1,632>604	1,266,641	795, 362	3,052, 042	489,13	1,072,042	1,490, 846
Average size of farm -----		556		2,096	738	356				42	
Corn For Grain:											
-----------------	1,486	1,041	162		242			445	65	380	-------------
AM*----- .:-----------	44,023	38,940	21,060	341	7,034	6 , ; ;	3, 992	5,083	65	5,018	-------------
Sorghums for grain:											
----------------		242						357			
Acres.-----------.---- -	20, 423	15,815	2, 760	3, 618	3 , 3 ;	4 , %	1, 710	4,608	3 , %	420	618
Wheat:											
Farms----.-------.-.-.-	2,986	2,125		297	443	528	791			374	
Acres -----------------	172,877	158,488	7 , &	55,707	20,992	42,824	31,425	14, 389	3 , %	7,656	3 , %
Soybeans:											
Farms											
A c r e s - ~ ~ : : : : : : j : : : : : : : : : : j	: j : : : : : : : :										
Hay:											
-'-::;?----------------	16,666	5378	501	522	1,358	1,344	1,653	11,268	1,239	8,022	2,057
-----------------	517,776	350,058	46,353	56,959	104,257	90,034	52,455	167,718	24,053	119,349	24,346
Cotton:											
Farms ----------------	537	318			108			219	-------------		
Acres -----------------	18,935	17,612	6,860	4,551	4,266	1,731	204	1,323	-------------	1,143	180
Tobacco:											
farms ----------------------------	---------	---------	---------	. . . .	. . . . . .	---------	---------	---------	---------	---------	---------
Acres ----------------------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
Cattle and calves:											
----------------	33,403	8,626	621	578	1,502	2,259	3,692	24,751	3,125	17,941	
Number -------------	932,284	724,168	172,546	126,325	175,834	116,862	132,861	207,856	34,291	130,088	43,467
Hogs and pigs:											
Farms.~-...----.-----.	5,977	1,779	-------------				529	4,198	7,217	2,585	
Number.--.-------.---.	113,851	80,514	-------------	7,360	2 0 , %	35,474	16,934	33,337	5,150	25,811	2,376
Hens and pullets:											
--------------	8,541	2,115		123	224		744	6,426		4,168	1,218
Number ---------------	532,012	383,111	1,938	1,845	47,306	323,856	18,166	138,901	17,416	94394	30,091
Total value of products sold:											
--------------	47,895	13,460	1,011	1,030	2,210	3,551	5658	34435	5,377	23,231	5,827
Dollars(l,000)l ---------	215,500	191,771	85,897	3&155	30,673	24,568	20,358	23,715	5,188	14,450	4,077

[1] Data does not add due to rounding.
[2] Does not include data for Alaska and Hawaii.

Note: Includes an estimated 314 abnormal farms. Figures are estimates based on a sample and are subject to sampling errors.

TABLE 6.—CHARACTERISTICS OF FARMS MISSED IN THE CENSUS BY TYPE OF FARM

	Total	Cash-grain farms	Tobacco farms	Cotton farms	Other field crop farms	Vegetable farms	Fruit and nut farms	Poultry farms	Dairy farms	Livestock farms and ranches other than poultry and dairy	General farms	Miscel-laneous farms
UNITED STATES												
Number of missed farms	476, 670	42, 305	24, 565	5, 069	3, 396	10, 092	12, 322	11, 147	22, 712	270, 218	50, 833	24, 011
Land in farms	56, 360, 304	7, 362, 825	1, 278, 031	857, 563	368, 889	400, 903	487, 720	499, 616	4, 291, 148	34, 207, 622	5, 191, 274	1, 414, 713
Average size of farm	118	174	52	169	108	39	39	44	188	126	102	58
Corn for grain:												
Farms	96, 140	21, 261	7, 131	1, 379	608	1, 578	356	1, 133	8, 451	42, 976	8, 867	2, 400
Acres	2, 349, 694	994, 792	91, 254	8, 496	20, 474	7, 913	712	18, 849	244, 141	788, 490	165, 471	9, 102
Sorghums for grain:												
Farms	7, 142	2, 849		60		18	858		220	2, 689	448	
Acres	370, 895	241, 510		3, 363		90	2, 574		220	110, 408	12, 730	
Wheat:												
Farms	20, 642	7, 533	393		184	82		547	1, 355	7, 659	2, 030	859
Acres	879, 981	576, 500	1, 560		1, 728	1, 334		2, 964	28, 792	190, 085	75, 406	1, 612
Soybeans:												
Farms	33, 412	17, 052	2, 779	1, 185	344	249			1, 731	7, 574	2, 166	332
Acres	1, 496, 212	872, 043	18, 139	214, 346	11, 032	2, 737			85, 938	218, 411	67, 922	5, 644
Hay:												
Farms	147, 107	9, 059	4, 462	635	635	814	341	926	13, 221	65, 535	42, 796	8, 683
Acres	2, 795, 235	159, 959	54, 866	5, 799	7, 079	12, 644	10, 499	10, 113	560, 570	1, 158, 979	744, 016	70, 711
Cotton:												
Farms	11, 929	1, 799	303	5, 069	147		160	126	47	1, 952	2, 241	85
Acres	308, 240	38, 470	1, 724	207, 368	5, 196		1, 280	1, 176	1, 880	19, 315	31, 491	340
Tobacco:												
Farms	34, 734	329	24, 565			08	214	425	728	4, 158	4, 207	
Acres [1]	71, 456	518	61, 581			165	107	1, 000	594	2, 975	3, 514	
Cattle and calves:												
Farms	*297, 753	7, 159	7, 537	1, 484	950	3, 426	1, 512	2, 803	22, 379	214, 265	23, 266	12, 972
Number	*5, 819, 584	146, 048	41, 599	12, 899	16, 316	39, 182	13, 187	28, 433	881, 406	4, 377, 477	210, 945	52, 092
Hogs and pigs:												
Farms	123, 416	5, 793	7, 861	984	711	3, 054	680	1, 778	6, 100	82, 741	10, 931	2, 783
Number	2, 818, 818	105, 085	103, 348	4, 306	19, 610	29, 862	4, 293	14, 175	273, 920	2, 089, 020	157, 159	18, 040
Hens and pullets:												
Farms	137, 851	7, 454	4, 408	1, 957	941	1, 434	1, 522	9, 821	5, 897	84, 013	15, 560	4, 844
Number	14, 198, 839	178, 222	125, 710	24, 372	26, 768	12, 856	36, 017	9, 567, 412	713, 765	2, 820, 212	613, 268	80, 237
Total value of products sold:												
Farms	453, 419	41, 443	24, 565	5, 069	3, 396	10, 092	11, 766	11, 048	22, 672	263, 561	49, 858	9, 941
Dollars (1,000) [1]	1, 501, 766	224, 545	78, 942	33, 981	26, 089	16, 123	50, 405	62, 798	258, 707	567, 206	65, 049	117, 809

NORTHEAST

Number of missed farms	39,143	2,333	159		508	845	848	1,512	4,850	16,736	6,429	4,923
Land in farms	3,012,141	117,034	1,378		51,595	16,362	60,345	62,223	946,535	1,084,886	497,008	174,775
Average size of farm	76	50	8		101	19	71	41	195	64	77	35
Corn for grain:												
Farms	8,051	1,408	53					126	961	3,792	1,210	501
Acres	69,921	27,598	59					9,540	7,260	8,391	5,540	1,433
Sorghums for grain:												
Farms	36	18				8						
Acres	234	44				0						
Wheat:												
Farms	516	642						9	694	742	242	106
Acres	831	7,653						1,80	180	4,366	726	106
Soybeans:												
Farms	48	48										
Acres	1,338	338										
Hay:												
Farms	21,309	797			134	15	137	530	3,325	7,903	6,195	2,273
Acres	391,435	14,366			641	30	6,850	9,557	148,047	100,437	93,092	18,415
Cotton:												
[illegible]												
Acres												
Tobacco:												
Farms	159		159									
Acres	344		344									
Cattle and calves:												
Farms	23,637	288			29			400	4,850	13,272	2,632	2,166
Number	319,481	1,757			116			677	182,507	112,978	12,852	8,594
Hogs and pigs:												
Farms	6,078	160			29		53	123	1,275	2,905	1,025	508
Number	50,097	250			58		212	555	3,671	39,258	5,099	994
Hens and pullets:												
Farms	8,515	22[illegible]			208		234	1,323	1,222	[illegible]362	1,446	497
Number	1,[illegible]32,375	4,51[illegible]			5,805		1,700	1,217,155	30,115	[illegible]235	56,318	5,529
Total value of products sold:												
Farms	37,384	2,333	159		508	845	848	1,512	4,850	16,736	6,429	3,164
Dollars (1,000)[1]	185,297	3,810	477		3,586	1,037	2,754	9,418	64,062	15,151	3,403	81,582

See at end of ta

EVALUATION OF COVERAGE—Continued

TA³L 6.—CHARACTERISTICS OF FARMS MISSED THE CENSUS TYPE OF FARM—Continued

	Total	Cash-grain farms	Tobacco farms	Cotton farms	Other field crop farms	Vegetable farms	Fruit and nut farms	Poultry farms	Dairy farms	Livestock farms and ranches other than poultry and dairy	General farms	Miscellaneous farms
NORTH CENTRAL												
Number of missed farms	134,634	22,339	782	182	271	2,125	1,000	5,326	9,757	68,393	16,413	8,046
Land in farms	17,875,095	4,677,658	58,254	3,640	,897	72,597	9,964	42,823	2,609,061	8,287,312	1,549,096	462,793
Average size of farm	132	209	74	20	7	34	9	26	267	121	94	57
Corn for grain:												
Farms	35,700	10,129						682	4,459	16,546	3,626	
Acres	1,728,313	816,203	4,644					3,694	208,488	603,167	92,117	
Sorghums for grain:												
Farms	4,288	1,899								2,389		
Acres	228,393	123,556								104,837		
Wheat:												
Farms	11,556	4,597						457	559	5,313	630	
Acres	545,628	355,138						1,164	22,350	132,732	34,244	
Soybeans:												
Farms	20,669	11,583	258	182					1,731	5,620	963	332
Acres	1,056,469	742,193	774	1,274					85,938	204,501	16,145	5,644
Hay:												
Farms	55,669	5,353	25°			605		356	6,883	24,199	14,927	3,088
Acres	1,212,179	79,355	2,580			7,840		356	337,239	494,540	266,564	23,705
Cotton:												
Farms	364	182		182								
Acres	3,458	2,184		1,274								
Tobacco:												
Farms	1,040		782							258		
Acres	907		778							129		
Cattle and calves:												
Farms	76,913	3,940	258			296	251	841	9,757	49,629	7,966	3,976
Number	1,936,134	91,963	2,322			296	1,506	3,139	508,336	1,231,384	81,047	16,141
Hogs and pigs:												
Farms	32,345	1,765				546		293	3,124	23,167	3,450	
Number	1,586,471	50,036				1,934		293	254,758	1,195,125	84,325	
Hens and pullets:												
Farms	37,768	3,007						4,644	2,267	21,382	4,750	1,718
Number	2,973,656	44,816						788,555	328,310	1,475,189	298,393	38,393
Total value of products sold:												
Farms	129,250	22,339	782	182	271	2,125	1,000	5,326	9,757	68,142	16,413	2,913
Dollars (1,000)[1]	620,545	175,598	955	163	121	3,903	816	19,690	142,466	244,462	19,445	12,901

[1] Data does not add due to rounding.

Note: Includes an estimated 314 abnormal farms. Figures are estimates based on a sample and are subject to sampling errors.

[The following paper was requested from the Bureau of the Census by OTA :]

STATEMENT OF BUREAU OF THE CENSUS, U.S. DEPARTMENT OF COMMERCE, WASHINGTON, D.C.,

SUMMARY

This paper presents the views of the Bureau of the Census relative to recommendation 4 of the OTA Food Advisory Committee (FAC) Report, Food, Agriculture and Nutrition information Systems: Assessment and Recommendations, which proposes a study of the desirability and feasibility of integrating the staff and activities of the agriculture census into the Statistical Reporting Service (SRS).

This paper also addresses the Issues raised in the FAG report concerning the quality, timeliness, and cost of the agriculture census program. Finally the paper describes improvements introduced into the 1974 agricultural census program and proposals for additional improvements *in* later agriculture census programs.

The Bureau's views, presented in the more detailed sections of this paper, are summarized below:

1. ***Transfer of Agriculture Census Responsbility to the Statistical Reporting Service of the U.S. Department of Agriculture***

The Bureau's view is that consolidation and integration of the agriculture census, now conducted by the Bureau of the ***Census,*** into the Statistical Reporting Service of the U.S. Department of Agriculture would not result in the gains in quality, timeliness, and reduction in costs to the Government described in the FAC report. It should be noted that the FAC report does not document anticipated gains.

It is exceedingly important that an independent agency, such as the Bureau of the Census, continue collecting benchmark data and that these data be obtained from a complete census of agricultural enterprises. Thousands of individuals and organizations rely on the agricultural statistics published by the Census Bureau as an independent source of data in using agricultural data from other sources.

Apart from the distrust that will inevitably be aroused in the user community by a merger of the independent data collection function with the data analysis and policy making function-we feel that there will be a substantial rise in cost (unless offset by serious cutbacks in the amount of data collected or in the level of geographic detail published) coupled with a deterioration in quality and timeliness of the results if the merger is effected. We, therefore, strongly recommend that responsibility for conducting the census of agriculture remain with the Bureau of the Census.

2. ***Coverage and Coverage Improvement***

The contention in the FAC report that "incompleteness in coverage of the ***agri***culture census and technological advances by the Statistical Reporting Service have resulted in the SRS providing the more dependable national estimates" is an assertion not documented by fact. Nowhere in the report are the technological advances by SRS described. The report says nothing about the reliability or coverage of SRS data at the subnational level. In contrast to the Bureau of the **Census,** which has provided measures of undercoverage in its censuses since 1945. SRS does ***not*** publish information on the degree of undercoverage in its surveys. This definitely misleads the user about the quality of SRS data.

While the Bureau continues to be concerned with the socioeconomic characteristics of farmers and farm families. this concern is not as closely related to a census of agriculture as it was when the U.S. was an agrarian nation. To close this major data gap in "statistics pertaining to rural people or households" cited in the American Agribusiness Associates report, major household enumerative surveys conducted by the Bureau of the Census can serve as a basis for a strengthened program of Information about people and households in rural areas. For example, the Current Population Survey annually covers more than ***twice*** the estimated number of households in rural areas covered by the enumerative surveys of the Statistical Reporting Service.

3. *Timelines of Census Results* „

The Food Advisory Committee (FAC) contention that a data series developed by a non-using agency is given only second or third priority in its work schedule is not true with regard to the Bureau of the Census. Collection and publication of general-purpose data is the Bureau's basic mission. The Bureau is not the user of the Weekly Retail Sales report, the Housing Starts report, the Manufacturers' Shipments, Inventories and Orders report or a host of other economic indicators; yet these series are released by the Bureau on an extremely tight time schedule. Moreover, the Bureau is constantly seeking to improve the timeliness of its census benchmark reports.

It is important to note that USDA's time schedule for its Proposed sample survey to be conducted in lieu of an agriculture census is inferior to that of any recent agriculture census conducted by the Bureau. The plan proposed by USDA requires 24-28 months from the reference period until the publication of results.[1] This proposal of USDA, coupled With the generally inferior utility of sample estimates as compared with census results for small areas is a step backward.

4. *Mailout[Mailback*

The problem of how to improve coverage in the agriculture census has concerned the Bureau for some time. It was to correct this deficiency rather than (as claimed in the FAC report) to reduce costs, that the Bureau changed in the 1969 census from an enumerative field canvass to a mailout/mailback canvass. Thus, the principal reasons for the change were to improve coverage of the large significant farms; to improve the overall quality of results; and to reduce respondent burden. 'This change in technique will have important short and long term benefits to the agriculture census program.

5. Transfer of *Mailing* **List to** *USDA*

The proposal of Agribusiness Associates also recommended that a directory of farms be established within the USDA through transfer of the agriculture census mailing list from the Bureau of the Census to USDA. The directory would be maintained by USDA and would be used primarily as a sample frame for the surveys discussed above. This is not a viable proposal for under the strict confidentiality proscriptions set forth in Title 13 of the U.S. Code, these records cannot be made available to the Department of Agriculture In view of the current climate, with regard to the need to maintain the confidentiality of information reported to the Census Bureau, it is unlikely that existing legal restrictions will be relaxed in order to release confidential information. These restrictions were reinforced by the Privacy Act which identified the Census Bureau as the sole agency to which identifiable records may be transferred for statistical purposes without consent of the individual.

6. *Improvements to the Census of Agriculture Program*

a. Timeliness *of* Publication.—Because of changes introduced into the processing of the agriculture census we are releasing the initial reports of the 1974 census on a substantially better schedule than that achieved in 1969. Our publication plans for the proposed 1978 Census of Agriculture (to be taken in 1979) call for a further acceleration so that the publication of preliminary county reports would start by October 1979 and be completed by March of 1980. These shifts in publication dates would provide results in a time period consistent with the dates cited as desirable in the FAC report.

b. Processing Capacity.—The Bureau of the Census has already considerably expanded its computer facilities for handling massive processing operations on a concurrent basis. Additional expansions have been approved and will be installed over the next few years.

A shift in the reference year for the next two censuses of agriculture has been proposed. By 1982 the agriculture and the economic censuses would have the same reference period. This would lead not only to the development of better lists and improved coverage but should also lead to better classification of agricultural activities. It will also permit compiling data on agricultural activities related to other economic enterprises.

c. **Data** Improvements.--In addition to the above the Bureau is proposing a program to link agriculture data and economic census data. This program will match and link suppliers and services for the agriculture sector with the actual agriculture production and in turn, the production with the processing and

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[1] See Hearings Before the Committee on Post Office and Civil Service, U.S. Senate, SJ Res. 95, May 23, 1973.

marketing of agricultural commodities. These data are essential to a better understanding of how changing economic structures affect traditional agricultural production patterns. Linkages are proposed to both the other economic *censuses* and to the Bureau's annual Company Organization Survey. Such important linkages to economic census information could not be undertaken if another agency collected the agriculture census data, because of confidentiality provisions under which the Census Bureau operates.

d. ***Evaluation of Results.--The*** agriculture census evaluation program-which we have conducted for every agriculture census since 1945--will be expanded to develop a better understanding of the coverage of marginal and nonresident operators.

One should keep in mind that errors are inherent in all censuses and all surveys. Therefore, a combination of a census and a superimposed independent sample survey can provide estimates based on more complete coverage than a census itself. This paired approach has been used by the Bureau of the Census to evaluate its censuses of agriculture. This has permitted us to inform users of agriculture census data as to the quality and has provided us with information for improving future censuses.

A detailed presentation of the views of the Bureau of the Census is found on the pages following.

DETAILED PRESENTATION OF BUREAU OF THE CENSUS VIEWS

Introductory

The Bureau of the Census, as the Government's principal general-purpose statistical agency, welcomes the efforts to improve agricultural statistics. Our interest in agriculture activity dates back to 1840 when we undertook the first U.S. census of agriculture. During the intervening 135 years, the Census Bureau has conducted 19 nationwide enumerations of U.S. agriculture.

A1though our responsibility relates primarily to providing the periodic benchmark data derived from the censuses of agriculture, our interest and attention far exceeds that basic function. Over the years we have become conversant with both agriculture data users and 'agriculture data providers. We have also maintained and benefited from a close liaison with the professional statisticians in the U.S. Department of Agriculture (USDA). We have been gratified that the improved techniques in the fields of sampling, collection, processing, etc., developed at the Bureau have been adopted by other agencies.

We are acutely aware of how U.S. agriculture has changed during the last five decades, with the increasing application of technology and science to agriculture production. Although the number of farms has declined over the years, there has been an accompanying substantial increase in the size and complexity of agricultural enterprises.

The need for improved measures in the agriculture sector has never been greater. We have directed our efforts to this end and fully endorse all serious efforts to provide improved agriculture statistics whether they be interim measures of current activity or important periodic benchmarks of an agriculture census.

Alternatives to the existing data system, however, should be developed without sacrificing the important benefits deriving from the census of agriculture, which include major benchmarking of agricultural activities every 5 years. This census is the only source of agriculture data at the county level on a nationwide uniform basis.

Proposal to Transfer Agriculture Benchmark Statistics to the U.& Department of Agriculture (USDA)

The contention of the American Agribusiness Associates cited in the Food Advisory Committee (FAC) report that more timely and accurate benchmark data could be provided by the USDA Statistical Reporting Service at the same or lower cost than by the continuation of the 5-year agriculture censuses *con*ducted by the Census Bureau is neither documented by facts nor supportable. The FAC report also contends that "other users" of agriculture census data believe that both the reliability and timeliness of such data could be improved at less cost if the responsibility for providing such data were transferred to the Statistical Reporting Service. Unfortunately the FAC report does not identify the users who hold these views nor does it describe the basis for their beliefs. It is safe to say that contrary views are widely held.[2]

[2] See footnote 1, page 374,

The American Agribusiness Associates report reflects a failure to understand' the decentralized Federal statistical system. Under the present Federal statistical syst.em the responsibility for periodic data collection has been maintained functionally separate from data analysis and policy formulation. The Bureau of the Census is responsible for providing general-purpose data concerning the American economy. Other agencies analyze the data for purposes of policy formulation. Transferring the agriculture census or benchmarking to USDA, which is also responsible for agriculture *programs* and policy, would merge these functions within a single organization.

To have the same *agency* collect by survey what would purport to be benchmark statistics and also collect and publish annual estimates could lead to conflicts of interest. A department responsible for crop estimates, other projections relating both to production, domestic use, and potential exports, and the administration of programs bearing directly on the final outcome of many of those estimates would be subject to great pressures to publish statistics that would reflect favorably on its handling of program responsibilities, or at least would be perceived to be so subject. Such actions could deteriorate further the public's confidence in Federal statistic.

It is exceedingly important that an independent agency, such as the Bureau of the Census, continue collecting benchmark data and that these data be obtained from a complete census of agricultural enterprises. The agriculture census information also is the basis for many Federal, state and local programs. Thousands of individuals and organizations rely on the agricultural statistics published by the Census Bureau as an independent yardstick in using agricultural data from other sources.

According to the proposed plan of American Agribusiness Associates, the anticipated improvement in timing and reduction in cost of the program, if transferred to the Agriculture Department, would come about by discontinuance of the agriculture census program currently conducted by the Bureau of the Census and substituting a variety of rotating sample surveys. This proposal in essence, would reduce the cost of the program by reducing the amount as well as the quality of data produced.

Leaving aside the legalities involved in discontinuing the census, the census of agriculture provides the only complete series of agricultural data available at the county level.

In order to provide county data, *now* collected on a systematic standardized basis throughout the U.S. only in the agriculture census program. It was proposed that a once-in-five years expansion of the sample be undertaken. It was felt that the expanded sample would be adequate to provide the required county data. The adequacy of the proposed sample derived data for the wide range of local area data users, the size of the sample that would be need@ and its level of reliability are not documented in the Agribusiness report.

The plan suggests that a moderate infusion (not quantified) of Federal funds into the state agriculture programs would provide additional county data. if needed. It is unlikely that the kind of data produced by the states would be suitable for aggregation to national totals. States are interested primarily in agricultural activities important to their economy and are much less likely to collect information of general interest.

This means that measures of the total market activity would be difficult, if not impossible, to develop. Even in instances where the measurement of a common set of activities would be acceptable to each participant state, information from organizations whose activities cross state lines would be difficult to come by let alone to assess once obtained.

The level of statistical expertise varies widely among states and this may impact seriously on the quality of the aggregated data. Another problem would be timing. Will all the state produced data be available in time to meet publication requirements? If not, the anticipated gains in timing would vanish. Finally. what about the cost of the program? The cost to support the statistical staffs and overheads of the 45 to 50 states participating in a data program is certain to be much higher than the coat of supporting a single staff collecting the same data by mail. This would result in a substantial increase over current costs rather than a decrease.

The proposal of Agribusiness Associates also recommends that a directory of farms be established within the USDA through transfer of the agriculture census mailing list from the Bureau *of* the Census to USDA. The directory would be maintained by USDA and would be used primarily as a sample frame for the surveys discussed above. This is not a viable proposal for under the strict confidentiality proscriptions set forth in Title 13 of the U.S. Code, these records cannot be made available to the Department of Agriculture. In view of the current climate, with regard to the need to maintain the confidentiality of information reported to the Census Bureau, it is unlikely that existing legal restrictions will be relaxed in order to release confidential information.

Timeliness of Census Results

The FAC contention that a data series developed by a non-using agency is given only second or third priority in its work schedule is not true with regard to the Bureau of the Census. Collection and publication of general-purpose data is the Bureau's bade mission. The Bureau is not the *user of the* Weekly Retail Sales report, the Housing Starts report, the Manufacturers' Shipments, Inventories and Orders report or a host of other economic indicators; yet these series are released by the Bureau on an extremely tight time schedule. Moreover, the Bureau is constantly seeking to improve the timeliness of its census benchmark reports.

It is important to note that USDA's time schedule for its proposed sample survey to be conducted, in lieu of an agriculture census is inferior to that realised by any recent agriculture census conducted by the Bureau. The plan proposed by USDA requires 24-28 months from the reference period until the publication of results.[3] This proposal of USDA, coupled with the generally inferior utility of sample estimates as compared with census results for small areas, is a step backward.

The Committee's observation that recent agriculture censuses have not been released as promptly as those of earlier *years* does not give proper recognition to a number of factors that should be considered when comparing census release dates over time. One must not compare apples and oranges. For example, in the earlier censuses, the content of the preliminary reports was more restricted than that of the reports issued in the later census years. The 1939 preliminary **county reports consisted of roughly 3,000 pages, whereas** the 1969 county census reports consisted of about 24,500 pages. In addition, the 1989 census reports incIuded basically final, rather than preliminary data.

Because of changes being introduced here at the Bureau, we are releasing the initial reports of the 1874 Census of Agriculture on a substantially better schedule than achieved in 1989. The release of the flint preliminary report from the 1974 census bettered, by several months, the 1969 schedule. More Significant, however, is that the reports should be released on a schedule fully comparable to that achieved in the earlier censuses which issued more abbreviated preliminary reports.

Our publication plans for the proposed 1978 Census of Agriculture call for a further acceleration so that the initial publication of county reports would start by October 1979 and be completed by March 1980. These publication dates would provide results in a time period consistent with dates cited as desirable in the FAC report.

Coverage and Coverage Improvement

The contention by FAC that "incompleteness in coverage by the agriculture census and technological advances by the Statistical Reporting Service have resulted in the SRS providing the more dependable national estimates" is an assertion not documented by facts. Nowhere in the report are the technological advances described. The report says nothing about the reliability of (SRS data at the subnational level. Furthermore the report does not describe the degree of undercoverage in the SRS surveys. In contrast to the Bureau of the Census, which has provided measures of undercoverage in its *censuses since* 1945, SRS does not publish information on the degree of undercoverage in its surveys, nor on the sampling errors of its estimates. This definitely misleads the user about the quality of SRS data.

If the universe to be covered by a census or survey can simply be defined as a list of "known" units, (whether the list resulted from field canvasses or from administrative records) the coverage of the census or survey can be made as complete as respondent cooperation makes possible. This would be the case, for example, if the universe of a census or sample survey of agriculture were defined to be those units listed in a farm directory. This is not presently the case in agriculture surveys nor censuses! Rather, the universe is defined in terms of all units which meet a combination of criteria based on acreage and value of

[3] See footnote 1, page 374.

sales. Coverage thus depends upon identifying all units potentially within the scope of the census or survey and obtaining correctly for each unit the information, needed" to determine whether or not the unit satisfies the definition of a farm. Since all censuses and surveys are subject to error on the part of enumerators and respondents, complete coverage of the intended universe cannot be attained with this kind of definition even with full respondent cooperation.

Despite the error inherent in all censuses and surveys, a combination of a census and a superimposed independent sample survey can provide estimates based on more complete coverage than the census itself even if the coverage of the sample survey is inferior to that of the census. The combination of a check survey with the census makes it possible to provide estimates of coverage with sampling errors small enough to detect undercoverage of just a few percentage points in the census. However, the evaluation must be based on matching and" comparison of data from individual farms in the check survey and the census. It cannot be carried out merely by comparing aggregate statistics from the two sources.

As indicated earlier, since the 1945 Census of Agriculture of the Bureau of the Census has used this technique to evaluate the completeness of coverage of its agriculture censuses with regard to the number of farms and land in farms and—since 1964-also the value of sales. These evaluations have been carried out so that Census Bureau can inform users of its data as to their quality, and to provide the Bureau with information for improving future censuses. In future censuses the agricultural census evaluation program will be expanded to develop a better understanding of the coverage of marginal and non-resident operators.

Coverage ***Experience in Prior Censuses of Agriculture***

Estimates from the evaluation study of the 1969 census indicate that there was. a substantial increase in the number of small marginal economically insignificant farms mimed compared to earlier censuses. These farms, although they account for more than one-third of the total number of farms, account for only about two percent of the total value of farm products sold. In fact, because of the generally poor quality of their records only a limited amount of data are published for the small farms. Moreover, such farms cannot be realistically classified by principal agricultural activity. Although the results of the 1974 census are not yet available, it is felt that with better coverage of the larger, economically significant farms the coverage of farm production has been improved.

Differences between alternative survey and/or census approaches are to be found primarily in the treatment of smaller and marginal farms. The allocation of resources which should optimally be devoted to the coverage of smaller farms. should be justified and determined on the basis of the data objectives of the survey or census. Such decisions would differ for data about agribusiness and for data about people and households in rural areas. While efforts are being made to improve coverage of the small farms it is felt that the Bureau's agriculture census resources would be more effectively utilized by directing them toward improved coverage of economically significant enterprises. Substantial improvement in the coverage of smaller and marginal farms can only be obtained through a household survey approach.

The problem of how to improve coverage in the agriculture census has concerned the Bureau for some time. It was to correct this deficiency, rather than to reduce costs, as claimed in the FAC report that the Bureau changed in the 1969 census from an enumerative field canvass to a mailout/mailback canvass. Thus, the principal reasons for the change were to improve coverage of the large significant farms; to improve the overall quality of results; and to reduce respondent burden. This change in technique will have important short and long term benefits to the agriculture census program,

Censuses of agriculture, up through the census of 1964 had been taken by a field canvass using personal visits by census enumerators. Past experience indicated that this methodology had a number of shortcomings, of which an increasingly significant one was caused by the increasing number of farms operated by persons who do not live on the farms. This made it difficult for enumerators to find nonresident farm operators during door-to-door enumeration and resulted in farms being omitted from the census.

Another major complication that was expected to become more troublesome was the large and growing number of agricultural establishments that are comprised of non-contiguous tracts of land. In many instances, separate tracts lie in two or more enumeration districts, counties or even states. This caused enumerator assignment problems, and created uncertainty as to the land and agricultural operations that should have been included. The result was that some land areas were counted twice while others were omitted during the field operations and in the data tabulations.

In addition, experience showed that enumerators tended to miss part of the farms in their assigned districts, usually by failure to identify all the separately operated tracts or by failure to cover all back roads and trails.

Other problems were the increasing scarcity of qualified enumerators, the disappearance of clearly recognizable differences between suburban and rural farm areas, and the increasing mobility of farm people, making it more difficult for the enumerator to find the farmer at home. In addition, the increased diversity and complexity of enterprises engaged in agriculture activities coupled with a rise *in* "nonrecognizable" agricultural businesses, such as agricultural services, posed potentially serious problems in coverage of large farms. In 1966, when systematic planning for the 1969 Census of Agriculture started, it was clear that a basic change in data collection procedures-from an enumerative to a mail approach-deserved serious consideration.

Use of ***Mailout/Mailback Procedures in Other*** Censuses

For the **censuses of manufactures and mineral industries, retail and wholesale trade, and service industries, the change to a mail census had been made successfully over a decade earlier,** in 1948 for the Census of Manufactures and in 1954 for the Census of Business. For these censuses, a mailing list of establishments having employees was prepared from IRS records of firms subject to payments of Federal Insurance Contributions Act (FICA) taxes, and census reports were then collected by mail. In the Census of Business, in addition, data for "nonemployers" or zero-employee establishments were obtained directly from data extracted from tax returns.

This change in economic census procedures, in addition to reducing the costs of data collection and the burden on small respondents, resulted in coverage as good as that resulting from an enumerator canvass. Coverage was probably improved for certain types of "nonrecognizable" businesses, i.e., those operated from homes or on an itinerant basis, and for businesses not in operation at the time of enumeration.

'In subsequent economic censuses, costs and reporting burden were further reduced by using administrative records to furnish data for the smaller employers.

In a roughly parallel fashion, self-enumeration had been used with satisfactory results for a substantial part of the country in the 1960***Census of*** Population and Housing, and the Census Bureau was already committed, based on extensive research and testing of procedures, to use a mailout/mailback procedure for more than half of the population in the 1970 census. Research in the 1950 and 1960 censuses had demonstrated that, in addition to reducing collection costs, self-enumeration could be expected to improve the quality of census data for small areas by minimizing the influence of enumerators on the results. In the 1964 Agriculture Census, advance distribution of questionnaires, to be filled out and held for the Census enumerator, had demonstrated that at least a substantial proportion of farm operators were capable of completing the questionnaires themselves.

Information ***About Persons and Households in Rural Areas***

While we shall continue to be concerned with the socioeconomic characteristics of farmers and farm families, this concern is not as closely related to a census of agriculture as it was when the U.S. was an agrarian nation. The American Agribusiness Associates report cites the lack of information about rural people or households as "the biggest single gap in the existing statistical system." To close this gap, the major household enumerative surveys conducted by the Bureau of the Census best serve as a basis for a strengthened program of information about people and households in rural areas.

For example, the Current Population Survey annually covers more than twice the estimated number of households in rural areas than is covered by the enumerative surveys of the Statistical Reporting Service. The Census Bureau conducts other large scale national enumerative sample surveys which also provide information about people and housing in rural areas, and could be utilized to provide additional information not ***now*** collected if it were of interest to do so. An example is the 250,000 household Survey of Income and Education to be conducted in the spring of 1976. We believe it would be in the public interest, and efficient to the Federal Government, for the Department of Agriculture to utilize Bureau of the Census capabilities for conducting household surveys to obtain information about rural households needed by the Department.

Mailing Ltst Development

Although mail enumeration should be less expensive (and more appropriate in view of the changed nature of the agricultural enterprises) than the personal interview technique, the mail method requires extensive mailing list development and maintenance work in order to achieve full coverage without duplication.

We expect to improve coverage and accuracy by expanding our efforts to obtain better mailing lists; by construct% a more precise mailing register through using administrative sources more effectively; by improving unduplication techniques; by address linkage with the other economic censuses; and @using a short precanvass form to identify the type of operation of each farm, which in turn will reduce the respondent burden through the subsequent use of specialized data collection forms which pertain directly to the respondent's type of agriculture production.

Other Proposals to Improve Coverage and Data

A shift in the reference year for the census of agriculture has been proposed. This should lead to better classification and coverage of agriculture operations of agribusiness firms and the establishment of a base for compiling data on the integration of agricultural operations with other economic enterprises. Additional benefits would include improvements to the accuracy of the Commerce Department's GNP estimates. Much of the data obtained in the census of agriculture is economic in nature and these data are used in compiling the national accounts.

If the data for the agriculture census are collected for the same reference year as that of the economic censuses, there will be a universe list, which will permit the transfer from one census to another of enterprises changing their principal activity subsequent to the preparation of the mailing list.

The result will be a complete and unduplicated, coordinated, simultaneous and consistent treatment of all major economic sectors of the United States economy and will permit the unified planning and execution of the various census programs.

To accomplish the change over in an orderly manner, legislation has been prepared proposing that the next two censuses of agriculture be taken on a 4-year cycle. The 1978 agriculture census year would be 1 year later than the economic censuses scheduled for 1977. The economic and agriculture censuses would be for the same reference year in 1982 and thereafter. Thus, certain priority conflicts with the decennial census that occurred during the processing of the 1969 Agricultural Census will be avoided.

In the event the proposal is not approved, priority conflicts with the 1980 demographic census will still be minimized for the Bureau has considerably expanded its computer facilities for handling massive processing operations on a concurrent basis.

Proposed Data Expansion

The increase of the corporate type farm in today's agriculture sector has become a significant influence upon our agricultural activities.

For the 1974 census the Bureau requested increased funds to provide statistics that are more descriptive of the activities of these corporations. These would provide a measure of the agricultural activity in which such firms are engaged, without consideration of other economic activities of the corporations. The tabulations and publications would be developed from limited data collected in the 1974 census precanvass matched to the general census data. An expansion of this program is planned for the proposed 1978 census which would provide composite statistics about these corporation% including other economic activities in which they are engaged.

In addition to the above, the Bureau is proposing a program to link agriculture and economic census data. This program will match and link suppliers and services for the agricultural sector with the actual agriculture production, and, in turn, the production with the processing and marketing of agricultural commodities. These data are essential to a better understanding of how changing economic structures affect traditional agricultural production patterns. Linkages are proposed to both the other economic censuses and to the Bureau's annual Company Organization Survey. Such important linkages to economic census information could not be undertaken if another agency collected the agriculture census data, because of confidentiality provisions under which the Census Bureau operates.

The Census Bureau's Program of Fertilizer Statistics

Although not directly related to the agriculture census program discussed above, the report of the Food Advisory Committee criticized the timeliness of fertilizer data and recommended that studies be conducted and hearings held "to determine ways, means, and costs of improving fertilizer information systems. "

Monthly estimates of United States production and stocks of nitric acid, sulfuric acid, and ammonia and phosphatic fertilizer materials are published by the Bureau of the Census about 30 working days following the close of the reference month, Benchmark data for these products were published in the 1972 Census of Manufactures. Product class data are published annually in the Annual Survey of Manufactures.

We believe the quality of the monthly fertilizer production data to be good. Comparisons of the value of shipments estimates developed from the current survey with the 1972 census results show a difference ranging from one to three percent.

The monthly survey is continually monitored for coverage. The annual data published on number of production establishments by state, is reviewed by industry which notifies us of any potential short-fall in coverage, Industry also provides the Bureau with lists of all known producers. The chemical industry also participates in an advisory capacity in the development of data categories.

The Bureau of the Census participated in the Fertilizer Task Force meeting in August 1975, which was organized by the Economic Policy Board. In the course of this meeting, possible improvements of Census fertilizer data were discussed, including expanding manufacturing data, upgrading import and export product content to include products collected in the monthly survey, and the possibility of a retail stock survey to be conducted in the spring and the fall of each year.

While the Bureau of the Census is only one of many organizations that provide fertilizer data, it is actively seeking ways to improve its program.

Conclusion

The evidence is that the consolidation and integration of the quinquennial censuses of agriculture, now conducted by the Bureau of the Census, into the Statistical Reporting Service of the U.S. Department of Agriculture would ***not*** result in the gains in quality, timeliness, and reduction in costs to Government as stated in the report. To the contrary—apart from the distrust that will inevitably be aroused in the user community by a merger of the independent data collection function with the data analysis and policy making function—there will be a substantial rise in cost (unless offset by serious cutbacks in the amount of data collected or in the level of geographic detail published) coupled with a deterioration in quality and timeliness of the results. We, therefore, strongly recommend that responsibility for conducting the census of agriculture remain with the Bureau of the Census.

We also urge that the Department of Agriculture utilize ongoing Census Bureau surveys, and the Bureau's capabilities for conducting large-scale household surveys, to obtain needed information about people and households in rural areas.

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DEC 9 1975

Mr. J. R. Cordaro
Food Program Manager
Office of Technology Assessment
Congress of the United States
Washington, D. C. 20510

Dear Mr. Cordaro:

This is in reply to your letter of November 19 regarding the census of agriculture program.

1. Total expected cost of the 1974 Census of Agriculture

It is necessary to establish the background to the 1974 census in order to relate costs. Although the 1974 census followed essentially the same procedures as used for the 1969 census, it was much more limited in scope. The usual pretesting of new procedures and methodologies that precede a census were not conducted. The 1974 census appropriation was for a period 15 months shorter than normal, the associated censuses of irrigation and drainage were not included since they were conducted in 1969 and are conducted only every 10 years, and follow-on surveys on farm finances, horticulture, etc., were omitted. This abridgement occurred because of the delay in receipt of the census appropriation and the limitations placed on total expenditures. Taking the foregoing into consideration, the cost of the 1974 census is expected to approximate $23 million (exclusive of the October 1975 Pay Act and the December 1975 postage increase). There have been no significant differences between the appropriations for FY 1974 and 1975 and actual obligations.

2. Costs for the proposed 1978 and 1982 Censuses of Agriculture

The cost of the proposed 1978 census is expected to be higher than the 1974, since the 1974 census was significantly abridged in timing and scope. Since neither authority nor funding has been approved for staff to begin planning the 1978 census, detailed plans and cost estimates are not available at this time. Preliminary estimates indicate that the 1978 census, with the censuses of irrigation and drainage and the follow-on surveys as included in the 1969 census, should be comparable to the updated costs of the 1969 census. The 1969 census costs updated to current postage, salary, etc., would approximate $35 million.

2

This would include continued activity directed toward expanding the analytical information provided in the census by relating statistics on agricultural production to other economic activities. The two primary objectives in this expansion are: 1) to provide a measure of agribusiness through tracing the vertical flow from those supplying materials and supplies to the agricultural sector through the processing and marketing of the agriculture connodities ; and 2) to expand a report being developed for the first time for the 1974 census which will provide statistics on corporate activity in agricultural production. In addition, the Bureau will be evaluating new methods for collecting and processing the census, exploring improved uses of administrative records available from other agencies in order to reduce the reporting burden on the public and improve timeliness of the data, and expanding the evaluation and coverage programs for the census for use in planning improved systems for future censuses. It is too early to develop any cost estimates for the 1982 Census of Agriculture.

3. Status of collecting the 1974 data and issuing reports

The Bureau’s schedule calls for releasing preliminary county data reports for all 3,100 counties between December 1975 and April 1976. We are pleased to announce that the first reports have been sent to the printer and should be available within the next several weeks. The complete State reports are scheduled to be released beginning in April 1976.

If I can be of further assistance, please do not hesitate to call.

Sincerely,

VINCENT P. BARABBA
Director
Bureau of the Census

[The following paper was requested from the Statistical Reporting Service. U.S. Department of Agriculture by OTA:]

The Statistical Reporting Service appreciates this opportunity to comment for the record of the Technology Assessment Board. National and worldwide economic and agricultural developments since 1972 have probably generated more attention to and interest in the estimates and forecasts of the Statistical Reporting Service than at any time inthe102-vear history of agricultural estimates by the U.S. Department of Agriculture. The Statistical Reporting Service is the primary fact -collecting and fact-reporting organization of the U.S. Department of Agriculture and is responsible for National and State crop and livestock estimates and related statistical data and the coordination and improvement of the U..S. Department of Agriculture's statistical program.

One of the principal purposesof SRS is to present a picture of the current and near-future supplies of agricultural products. For crops, the annual cycle of reports begins with farmers' intentions to plant, followed by forecasts of planted acreages. acreages intended for harvest, probable yields, and forecasted production. Estimates of acreages harvested, actual yields, and production are made at the end of the season. Subsequently, reports on utilization, disposition, and value are issued.

Livestock inventory numbers are published annually or semiannually. Seasonal details on hog production, cattle on feed, and production of eggs, milk, and meat are issued during the year in monthly and quarterly reports. Reports on breeding intentions, farrowing, hatching, chick placements, and calf and lamb crops provide indications of prospective market supplies. Estimates of manufactured dairy products and cold storage holdings of agricultural commodities are also published on a regular basis.

Numerous associated statistics series are also reported: fertilizer use, number and size of farms, farm labor and wages, prices received and paid by farmers, grain stocks, honey, mink, mushrooms, naval stores, and weekly weather 'and crop bulletins.

In addition, an activity that has received an unusual amount of attention during the past three seasons is the Weekly Weather and Crop Bulletin, which includes estimates of relative progress of crop planting, development and harvest. These reports have provided weekly monitoring of unusual situations such as the planting progress during the extremely wet late planting season of 1973 and crop development during the short-term drought conditions of 1974 and 1975.

An important condition for virtually the entire statistical output of the Agency is that all estimates are based on current sample surveys and are not projections or estimates based simply on an evaluation of history, trends, or non-surveyed current developments. A unique feature of the Statistical Reporting Service among the primary Federal statistical agencies is that virtually its entire output of crop, livestock, and agricultural price statistics is released on a firm time schedule. Time and date of each release is published in "Crop Reporting Board Reports—Issuance Dates and Contents" which is distributed each December preceding the calendar year to which it refers. Moreover, its current estimates and forecasts during the growing season are typically released within 10 to 15 days after the collection of survey data.

Most of the major estimates and forecasts of the Statistical Reporting Service are subject at completion of the marketing year to comprehensive data on sales, marketing, movement and commodity usage which make it possible to rather precisely measure the estimating and forecasting performance of the Agency.

The world food and economic situation in 1973, with substantially increased demands for U.S. grain, contributed to abnormal economic stresses on the U.S. livestock industry, primarily related to increased feed prices. As a result, there was substantial speculation among the public and the livestock industry relating to reductions in sizes and numbers of cattle on feed. The higher feed costs resulted in shifting practices for the feeding of grains and concentrates so that long-standing relationships of cattle and hog inventories with disappearance and slaughter data would not hold. As a result, the inventory estimates of the Statistical Reporting Service on hogs, cattle on feed, and cattle were subject to unusually great scrutiny and question due to the general speculation that economic conditions should be forcing reductions of inventories. Speculation continued as the relatively large estimated inventories were not subsequently followed by usual patterns of livestock slaughter and disappearance. The record on slaughter and marketing now confirms the probability sample based estimates of the Statistical Reporting Service and would tend to confirm the estimates of heavier weights for cattle on feed, increasing cattle inventories, and greater reliance on roughage for gains, with the gains extended over a longer period of time. This series of events and conditions provided an unusual test of the estimating system of this Agency. Without the sampling surveys and techniques employed by the Statistical Reporting Service to estimate cattle on feed and cattle and hog inventories, the information available from utilizing common analytical procedures would have misled the public substantially regarding livestock inventories.

The Crops Estimates Program of the Statistical Reporting Service also has been subject to greater and more critical public interest and scrutiny than at any time in the past. The program starts each year with a December forecast of the following year's winter wheat crop acreage and production, then moves through farmers' intentions to plant major crop acreages as of January 1 and March 1.

Estimates of acreage planted to major crops are made as of July 1, Forecasts of yield per acre and production for major field crops are prepared throughout the growing season, starting with the December forecast of winter wheat production. The forecasting schedule is heaviest June through October but continues for the later field crops and ends with December forecasts for cotton and burley tobacco. Forecasts for cotton, corn, soybeans and winter and spring wheat utilize objective yield surveys. These are probability samples of very small plots randomly chosen and systematically placed in fields. The plots are visited throughout the growing season with counts of plants and fruits and other observations made for characteristics which possess usable relationships to mature yield.

The Statistical Reporting Service also prepares estimates quarterly of grain stocks stored on farm and off-farm. Stocks on farms are measured by mailed sample surveys and stocks off farms are the result of mailed surveys combined with enumeration of important storage facilities. The resulting sample coverage for off-farm stocks ranges from 80 to 90 percent of the total. Stocks estimates have been prepared quarterly as of July 1, October 1, January 1, and April 1 for wheat, barley, oats, rye, flaxseed, corn, and soybeans, except that a September estimate is prepared for soybeans which then are not included in the estimates for October 1.

A description of recent achievements of the Statistical Reporting Service must be prefaced by a review of major developments and achievements over the past 15 years. During this period, the methods, facilities and staffing of the Statistical Reporting Service have undergone revolutionary change and modernization as the Agency was successful in obtaining resources and direction to proceed with modern sampling techniques. In the early 1900's, the Agency completed construction of an area sampling frame, stratified by land use and has relied substantially on sample surveys from this frame each June and December to provide the principal inputs into estimates of major crop acreages and livestock inventories. The area sample frame provides an exhaustive record of all the land in the 48 States, classified by agricultural land use, and permits the selection of probability samples which totally assure that every acre of farm land and every farm has a chance of selection in each sample. Its greatest value lies in the fact that it is totally complete and that on the other hand, no elements in the population may be sampled more than once. This represents a substantial breakthrough in the sample survey process which is not possible by the exclusive use of lists, since it is impossible to evaluate lists to assure that no farm or operation is included more than once. Additionally, it is well-known that no totally complete list exists. Area samples have been most effective for producing precise estimates for the major crop acreages. The system also produces estimates of livestock numbers, but with sampling errors larger than for crop acreages. In 1970, the Statistical Reporting Service was authorized to develop survey procedures which would increase precision in its livestock inventory estimates. This project implemented what is known as multiple frame sampling. The procedure involves enumeration of large samples drawn from lists of livestock operations, accompanied by enumerated samples from the area frame. Since no list is totally complete, the area sample has been used to estimate for the incompleteness of the list population sampled, thus assuring complete coverage for the survey and an efficient information collection procedure. The coverage for multiple frame livestock surveys done in June and December has gradually been increased over the U.S. and in December 1975, the sample multiple frame estimates will cover about 95 percent of the total U.S. inventories of cattle and hogs. Livestock inventory estimates for the residual States with inventories too small to warrant multiple frame surveys and representing about 5 percent of total inventories. will utilize the December area sample survey. The mailed surveys long employed for livestock estimates have been discontinued. This has permitted the Agency to discontinue for livestock the old procedure of mailing inquires to large numbers of livestock operators and utilizing response from those who voluntarily respond in time to meet survey deadlines. The response to the enumerative surveys replacing these mailed surveys is much higher than for a mailed inquiry, and approaches 100 percent.

A 1973 development of the Statistical Reporting Service was the establishment of a system for rapid review, and August 1 revision if necessary, of the July 1 estimates of acreages planted to major crops. The procedure is based on a July update survey, a following subsample of the June Enumerative area sample survey, This permits a letter indication of the outcome of plantings which were reported for the June survey but may have still been intentions or not completed at the time of the June survey. The update survey was especially important in 1973 for providing badly needed update information following the very wet plant. ing season.

A significant development for the Statistical Reporting Service occurred in 1973, following enactment of the Agriculture and Consumer Protection Act of 1973. The Act directed the Secretary to report weekly export sales outstanding of major agricultural commodities and this responsibility was assigned to the Statistical Reporting Service. The task was substantially one of logistics, requiring prompt reporting by exporters, rapid review of reported data, and a high performance system for data processing, and rapid development and release of weekly results. A highly automated review and processing system employing an interactive input-output system to a large computer was developed by the Agency and employed operationally starting in October 1973. The Agency operated and further improved this reporting system until it was recognized as a function of the Foreign Agricultural Service and transferred to that Agency in December 1974.

Since 1970, an important continuing process of the Statistical Reporting Service has been formal program evaluation in which the statistical output of the Agency is examined for its relevance to current agricultural and economic needs and its effectiveness in terms of quality of output. The Agency first examined its program of crop estimates and as a result discontinued some crop estimates and forecasts in some minor States and the frequency of forecasting for crops in States of limited National importance. Subsequently, the Agency has reviewed the livestock estimates program and has made modifications similar to those for crops, that is, the discontinuance of least needed programs of estimates and elimination of estimates for some items in some States where the data possesses only minute importance in the National picture. Since then, the Agency has also modified its program for fruit and vegetable estimates and is in the process of examining its program of prices received and prices paid by farmers.

The final part of these comments will relate to discussions of some of the Agency's current needs.

One of the needs of the Statistical Reporting Service relates to greater protection of confidentiality for the data voluntarily supplied by the respondents to its many mailed and enumerative surveys. The Agency has never in its history of data collection committed a breach of confidence, and has been able to effectively guard these records with provisions of the regulations of the Department of Agriculture. Nevertheless, new developments create the need for explicit statutory protection of data from virtually all access except the use intended by its collection. New legislation such as the Freedom of Information and Privacy Acts and other laws which may be enacted in the future tend to focus public attention on confidentiality. The promise of complete protection, including protection from subpoena by the courts not now provided by the Privacy Act, may be necessary to achieve a high rate of voluntary response to surveys. In addition such protection, which is already present in the law. Title 13, under which the Bureau of the Census operates, would permit the Statistical Reporting Service the potential of greater efficiency of operation by access to administrative records of other Federal agencies. For example, the Statistical Reporting Service is barred from even limited access to IRS records which would greatly enhance its efficiency of sampling-yet the Census Bureau is granted such access for precisely the same statistical purposes. The Statistical Reporting Service is currently proceeding within the Department of Agriculture to draft proposed legislation to seek full statutory protection of survey data, and is hopeful that it will be quickly introduced and enacted by Congress.

The Statistical Reporting Service, in its role as the primary Federal statistical agency in the Department of Agriculture, provides reimbursable services to other agencies in the Department of Agriculture for survey design and operation. These activities are limited to what the Agency may undertake within its manpower resources, There is general feeling that some of the statistical survey activities by other Department of Agriculture agencies would be more effective if the Statistical Reporting Service could perform the design and data collection for them. The Agency's current limitation on the amount of these survey activities which it may accept is dictated primarily by manpower ceilings. To be more effective in providing agricultural survey services to other government agencies, the Agency would require permanent provisions for adding and developing professional staff.

Finally, the rapid schedule of release for the agricultural statistics of the Statistical Reporting Service is not matched by a program of similar scope anywhere else in the Government, but there nevertheless is tremendous pressure upon the Agency to shorten the time periods from data collection to release of estimates. It must be recognized that shortening the time periods for data collection and several subsequent survey and estimating procedures would be too costly economically or would promote deterioration of a quality output. An area to which the Agency attributes substantial potential for reducing time to release is in rapid data transmission and an optimum system and facility for data processing. Although the Agency has progressed substantially in equipping for and implementing these activities, it is in the process of seeking funds to proceed with a nationwide adaptation to a common data processing system and network.

This completes the statement for the Statistical Reporting Service and we again thank you for the opportunity to be included in the record of these hearings.

STATE OF NORTH CAROLINA,
DEPARTMENT OF AGRICULTURE,
Raleigh, N.C., December 5,1975.

Mr. EMILIO Q. DADDARIO,
Director, Office of Technology Assessment,
Congress of the United States, Washington, D.C.

DEAR MR. DADDARIO: I wish to report to you on the resolution passed by the National Association of State Departments of Agriculture No. MT-15 on "Agricultural Data Systems" a copy of which, I understand, has been submitted to your committee.

This resolution, which calls for the integration of agricultural statistics into a single system, is of great importance to farmers because of the burden that is being placed upon them to give reports to both the Department of Agriculture's Statistical Reporting Service and to the Bureau of Census. Evidence of this showed up in our State these past months as a reaction against the U.S. Census of Agriculture.

In addition and possibly of even greater importance is the fact that the U.S. Census of Agriculture is now obsolete in view of the new methods of getting farms and agricultural statistics through a sampling process which is employed by the Statistical Reporting Service.

The size, specialization and ownership of farms has changed to the point where it is no longer feasible to endeavor to make a canvass of all the farms in the United States to get the information. Therefore, a new system such as that suggested by the American Agri-Business Association needs to be put into effect.

There are two other advantages that I would like to stress. First, the information will become available much more promptly when it is needed than has been true with the Census for a long time. Second, when the data is collected in cooperation with the State Departments of Agriculture, as is done by the Statistical Reporting Service, it is most advantageous and efficient from the standpoint of the time, work, and expense that is incurred.

I urge your committee to give favorable consideration and support to this resolution.

Cordially,

JAMES A. GRAHAM, *Commissioner.*

AGRICULTURAL DATA SYSTEM

The complexities and rapid changes of modern agriculture have a great impact on farmers, the agri-business industry, and consumers. Effective planning and management of all phases of agriculture require statistical information with great detail, timeliness and accuracy. State Departments of Agriculture in cooperation with the Statistical Reporting Service have demonstrated that joint use of resources and personnel can minimize duplication and maximize efficiency of State and Federal agricultural statistics programs. Some overlap in the agricultural data programs of the Statistical Reporting Service and the Bureau of Census is resulting in inefficiencies and duplication of statistical services that adversely affect the quality of the total agricultural data system. A detailed report entitled "New Agricultural Data System Needed" has been developed by American Agri-business Association. The report reviews the total agricultural statistics program including the agricultural census and makes specific recommendations for improving agricultural data at the local, state and national levels.

RESOLVED, that the National Association of State Departments of Agriculture in convention at Charleston, West Virginia, October 9, 1975, endorses and pledges to work with the United States Department of Agriculture, Congress and the Executive Branch of the United States Government to implement the recommendations of the American Agri-business Associates as a means of effectively improving agricultural data through the implementation of a combined Federal statistical system built upon the existing Federal-State cooperative programs,

THE STATE OF FLORIDA,
DEPARTMENT OF AGRICULTURE,
Tallahassee, Fla., January 2, 1976.

OFFICE OF TECHNOLOGY ASSESSMENT,
Congress of the United States,
Washington, D.C. 90510,
(Attention Mr. J. B. Cordaro, Food Program Manager).

GENTLEMEN: I am writing to you on behalf of a resolution passed by the National Association of State Departments of Agriculture (NASDA) at Its annual convention in Charleston, West Virginia last fall relative to the agricultural census system.

I have enclosed a copy of this resolution entitled Agricultural Data System (MT-15). You will note in the resolution that NASDA is very much interested in developing an effective system of securing accurate agricultural statistical information based on existing Federal-State cooperative programing.

For many years complaints have been received from our farmers on the volume of work that had to be done regarding agricultural census and the fact that such census programs took so much time, that some of the statistics were useless, and that it took so long to get the facts and figures the census was supposed to acquire.

The NASDA office and its many allied state members have had a very successful relationship with the Statistical Reporting Service. Our past programs with that office have indicated that we were able to get out more useful information faster and much more accurately. The probability sampling approach has been perfected and is far superior as it relates to accuracy and timeliness than any other system of census taking used in the past.

We feel that the advantages of working with State Departments of Agriculture through our Washington office will enable the United States Government to get the census of all agricultural activities in greater detail, in speedier time, and on a more truthful level.

We endorse the concept proposed by the NASDA resolution and offer our complete support in pursuing and reaching the goals of the most effective agricultural data reporting system possible.

With warm personal regards, I am,

Sincerely.

DOYLE CONNER Commissioner.

AGRICULTURAL DATA SYSTEM

The complexities and rapid changes of modern agriculture have a great impact on farmers, the agri-business industry, and consumers. Effective planning and management of all phases of agriculture require statistical information with great detail, timeliness and accuracy. State Departments of Agriculture in cooperation with the Statistical Reporting Service have demonstrated that joint use of resources and personnel can minimize duplication and maximize efficiency of State and Federal agricultural statistics programs. Some overlap in the agricultural data programs of the Statistical Reporting Service and the Bureau of Census is resulting in inefficiencies and duplication of statistical services that adversely affect the quality of the total agricultural data system. A detailed report entitled “New Agricultural Data System Needed” has been developed by American Agri-business Association. The report reviews the total agricultural statistics program including the agricultural census and makes specific recommendations for improving agricultural data at the local, state and national levels.

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FEBRUARY 18, 1876.

Mr. DOYLE CONNER,
Commissioner, Department of Agriculture, The State of Florida, Tallahassee, Fla.

DEAR COMMISSIONER CONNER: I appreciate very much your sending me a copy of the resolution passed by the National Association of State Departments of Agriculture at its annual convention in Charleston, West Virginia.

I know that you would be interested in some of the work we are doing on our food information systems project. For this reason, I send you a copy of two papers that we have had prepared for this assessment to help us in judging the options that we will be presenting to the Congress on the issue related to whether the Bureau of Census' agriculture activities should be incorporated into the Department of Agriculture. The papers were prepared by Dr. Harry Trelogan and the Bureau of Census.

Again, my thanks and appreciation.

Sincerely,

J. B. CORDARO,
Food Program Manager.

[The following paper was requested from Mr. Frazier by OTA:]

STATEMENT OF FRANK FRAZIER PRESIDENT, AMERICAN AGRIBUSINESS ASSOCIATES, INC., McLEAN, VA.

INFORMATION SYSTEMS : FOOD, AGRICULTUBE, AND NUTRITION

The Office of Technology Assessment has rendered an invaluable service in pointing the way toward improved information systems for food, agriculture, and nutrition, by developing the twelve recommendations in the June 1975 report to their Food Advisory Committee.

This view is strengthened by comments on the report in papers presented by Dr. Don Paarlberg, Director of Economics for the U.S. Department of Agriculture; Dr. Harry C. Trelogan, until recently the Administrator of USDA's Statistical Reporting Service; and by the Bureau of Census of the Department of Commerce.

However, a review of the papers presented by Dr. Trelogan, and by the Bureau of Census, reveals a sharp difference of opinion as to the type of administrative structure needed for improving current information systems. Both agree new statistical tools are now being used that upgrade the accuracy of agricultural data. The Bureau of Census uses some in current sampling techniques to replace the enumerative field canvas used prior to 1$69.' And the Statistical Reporting Service uses recently developed multiple frame sampling techniques to reduce the standard error for @rep and livestock estimates from two to one percent.'

Congress has recognized the need to expand the utilization and implementation of these new statistical 'tools, and included $1,225,000 in USDA's 1975 appropriation to be used in compiling a list of names essential for multi-frame probability samplings

Significantly, the effect of the implementation of improved probability sampling methods, is crop and livestock statistics that surpass the quality of census data.' No longer, therefore, is census data needed to true up the accuracy of USDA's crop and livestock estimates. This gives rise to the charge that a continuation of the Census of Agriculture on the present pattern is a waste of time, effort, and money:

Since new statistical tools have already made data systems of former years archaic, information systems should now be updated to today's data needs, utilizing the economy and efficiency resulting from the improved statistical techniques which have proven effective.

Such a system could result from combining into a single administrative unit, a program of sample surveys that would integrate the present data being collected by SRS and the Bureau of Census.' This approach should more ade-

1 Census, p. 12.
Trelogan, p. 11.
3 Trelogan, p. 11.
4 Paarlberg, p. 4.
5 Trelogan, p. 7.
6 Trelogan, p. 1.

quately meet the needs of public and private decision makers, and also save $1,600,000 annually in federal funds.[7] Logically, the new system should 'be located in the Statistical Reporting Service, to which Congress has appropriated over 75 percent of current budget for agricultural data.[8] This agency has been out in front in developing and using improved statistical techniques. It competes for resources only with other agricultural services, rather than with all other statistical programs of the entire federal government.

Even so, the Bureau of Census anticipates that the integration of agricultural data systems, as proposed, would lead to a number of difficulties.

The Bureau claims to be an "independent agency," and for this reason should continue collecting "benchmark data."[9] The validity of such a claim is questionable. In USDA the collection of data in SRS is separated from the analysis of data by ERS. And why have "benchmark data" from Census, if they are using USDA surveys to help assure its accuracy?[10]

The Bureau claims failure to accept their views on the organization structure for data collection will lead to user "distrust," a substantial rise in data cost, and a deterioration of data quality and timeliness.[11] While a full scale feasibility study has not been made to either document or refute these charges, certain realities should not be overlooked. No agency in government has achieved a better reputation for safeguarding the confidentiality of data than SRS. Their officials go through "lockup" procedures several times a year. In the absence of the proof of any wrong doing, for any agency that releases agricultural data only once in the years to imply SRS officials are not to be trusted is both invalid and irresponsible.

The Bureau's claim that an integrated data system would result in a substantial rise in data cost not only is not documented, but it seems to completely discount the extensive experience of SRS with budgets involving multiple frame sampling . . . the technique now used for hog estimates in 23 states covering 96 percent of the population, and for cattle estimates in 38 states covering 96 percent of the population.[12] SRS claims the integrated system will result in a substantial saving , . . $36 million in contrast to $37.6 million annually for USDA crop and livestock estimates and the Census of Agriculture.[13]

The Bureau claims timeliness would be adversely affected by an integrated data collection system." Such a claim can hardly be accepted at face value when SRS announces a year in advance the date and the hour reports are to be released giving data collected, only a few days previously, and then meets the deadline. On the other hand, the Bureau of Census released reports on the 1969 agricultural census two to three years after the data was gathered. True, after the 1873 hearings on S.J. Res, 95, before the Senate Post Office and Civil Service Committee, the Bureau of Census promised to mend its ways.

The Bureau claims the FAC Report indicating SRS provides more dependable national statistics are not documented.[15] However, Dr. Trelogan cites the research of Professor H. O. Hartley, Texas A & M University, as the basis for improved statistical accuracy through the application of two sampling frames.[16] Dr. Trelogan indicated SRS, by increasing to a 25 percent sample, could obtain county data comparable in accuracy to that of the agricultural census.[17]

The Bureau claims Title 13 of the U.S. Code prohibits sharing the agricultural census mailing list with SRS.[18] If it is proper to protect the confidentiality of information in this way, then the law should be broadened to restrict access of one federal agency to the classified information of another. However, in many instances it may well be in the public interest for agencies to share such information and, therefore, perhaps Congress should modify the unique privilege restricted to the Bureau of Census.

The Bureau makes reference to a considerable expansion of computer facilities for handling massive processing operations on a concurrent basis.[19] Since many agencies now share computer facilities, there is no reason to believe adequate computer services could not be made available or transferred to SRS.

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7 Trelogan, p. 28,
8 Trelogan, p. 28.
9 Census, p. 1.
10 Paarlberg, p. 4.
11 Census, p. 2.
12 Trelogan, p. 10.
13 Trelogan, p. 28.
14 Census, p. 2.
15 Census, p. 2.
16 Trelogan, p. 8.
17 Trelogan, p. 23.
18 Census, p. 3.
19 Census, p. 4.

The Bureau is to be commended for suggesting a proposed program for linking agriculture data with economic data, as well as with other censuses and their Company Organizations Survey[20] But this undertaking should be approached with great care, because of the structural changes emphasized by both SRS and the Bureau of Census. No longer is a system of food production located in its entirety on a farm. For example, since the late nineteen forties, SRS has obtained information from hatcheries (an off farm source) as to the number of meat type chickens grown on farms. Nor are food production scheduling decisions necessarily made by farmers. In the broiler industry, they are geared to the financial resources of integrators, who contract with growers. Congress should not permit legal technicalities, or out of date laws to prevent the coordination among federal agencies that is essential to updating services to conform to the changing needs of users of their services.

In summary, recommendation number four in the FAC Report, calling for Congressional study of the transfer of the agricultural census into the Statistical Reporting Service, merits prompt implementation to determine the legislation needed to bring about such an integration of agricultural data systems. Paradoxically, SRS by utilizing new statistical tools has improved data quality to the point that "benchmark data" from the agricultural census is no longer needed. This progress should be applauded and enthusiastically supported. But instead, it seems to be overshadowed by an unfortunate jurisdictional rivalry that may thwart the adoption of the improved system recommended, which is so urgently needed by both public and private data users.

Beyond the question of who is to administer agricultural data systems, is the data needed to guide decisions, public and private, affecting food production and consumption. The twelve recommendations in the FAC Report all merit the careful and continued consideration by the Congress. Information system failures, such as experienced in 1972–73 with feed grains and many other commodities, illustrate emphatically the political pressures that are triggered by economic pressures growing out of decisions based on inadequate information.

In the future, to guard against compounding difficulties caused by the lack of such information, the Office of Technology Assessment has a unique and challenging opportunity to give real leadership. Significantly, the Office of Technology Assessment is the only point in the nation's government to which American agriculture can turn, that transcends jurisdictional boundaries of both Congressional Committees and federal agencies.

[The following paper was requested from Dr. Epstein by OTA:]

STATEMENT OF DR EDWARD S. EPSTEIN, ASSOCIATE ADMINISTRATOR, ENVIRONMENTAL MONITORING AND PREDICTION, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION. U.S. DEPARTMENT OF COMMERCE

WEATHER INFORMATION FOR ASSESSING CROP PROGRESS

Agricultural productivity has always been sensitive to fluctuations in local weather and regional climate. As global food reserves have decreased, and demand rises, natural weather and climate variability plays an increasingly important role in agricultural production and planning. Since 1972, the National Oceanic and Atmospheric Administration (NOAA) has taken several steps to improve its daily weather advisories to farmers, its weather-yield modeling research, and the content of its data publications. This report emphasizes summarization and publication of weather data that relate to crop progress during the growing season. It also gives a brief introduction to N0AA's new weather-yield modeling research.

The principal relevant NOAA periodical is the "Weekly Weather and Crop Bulletin", coedited and published by NOAA's National Weather Service and the Department of Agriculture's Statistical Reporting Service.[21] The NOAA office is

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[20] Census, p. 4.

[21] Publication of U.S. weather data relating to crop progress can be traced back to 1872. when a general 2-page "Weekly Weather Chronicle" was started by the Army Signal Service. In 18$?7, the newly named Signal Corps began publishing a "Weather and Crop Bulletin" weekly during the growing season and monthly during the rest of the year. In 1924. the current title. "Weekly Weather and Crop Bulletin", was adopted by the Department of Agriculture which included the Weather Bureau. When the Weather Bureau was transferred to the Department of Commerce in 1940. the publication became a cooperative effort jointly supported by funds appropriated to each Department.

located in Room 1137, South Agriculture Building. In addition to its editorial duties, the NOAA office monitors cumulative weather developments, provides monthly briefings for Department of Agriculture officials, and provides data and consultation to Agriculture agencies for planning and operating national programs dealing with the production of food and fiber. As an example, in early 1973, cumulative weather analysis showed that much soybean planting would be significantly delayed due to very wet fields. Accordingly, Agricultural officials increased acreages allowed for soybeans and a record harvest was realized.

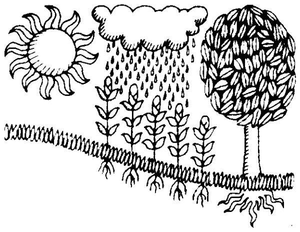
The Weekly Weather and Crop Bulletin is released each Tuesday noon throughout the year. Each issue contains precipitation and temperature data and narrative weather and crop summaries for each state and the nation. Circulation has nearly doubled since 1972 and is now about 5,300 copies. In response to the growing concern about the global food situation, NOAA began in February 1874 to prepare world maps of precipitation and temperature. These maps are published in the Bulletin—usually the third issue of each month. The maps show the distribution of the past month's average monthly temperature and total precipitation and departure from normal for the major agricultural areas of the world. Accompanying the maps is a narrative World Agricultural Weather Summary written by a specialist in the Foreign Agricultural Service. A recent issue of the Bulletin, including the world maps and summary, is appended to this report.

The Bulletin's monthly summaries permit only a general and somewhat delayed assessment of global crop situations. To achieve more timely information, NOAA specialists recently have written and are now refining complex computer programs that produce cumulative weekly statistics from conventional 6-hourly coded weather observations. Previously these data, long exchanged internationally, were discarded once used in preparing the next sequence of forecasts. This activity is taking time because of variations in coding practices and limitations of telecommunications facilities in some parts of the world. However, with the cooperation of the World Meteorological Organization, we are making progress in overcoming the difficulties and are already producing preliminary computer printouts of weekly global weather data for two to three thousand stations for use by Agriculture and NOAA specialists. If current progress is maintained, we may be able to realize accurate data consistently enough to justify publication of weekly data for selected foreign areas beginning during the spring of 1976.

We have also made progress in estimating accumulated precipitation from daily NOAA satellite imagery. Such satellite interpretation has been used to help analyze the extent of drought conditions in Haiti and the Dominican Republic during the first half of 1975 for the Department of State (AID). Satellite imagery is also an important source for information NOAA has been furnishing weekly this year to Food and Agriculture Organization (FAO) headquarters in Rome on monsoon rains over the Asian subcontinent. This information is being furnished at the request of FAO and is responsive to a resolution of last November's World Food Conference which called for establishment of a Global Information and Early-Warning System on Food and Agriculture.

NOAA, along with NASA and the Department of Agriculture, is participating in the Large Area Crop Inventory Experiment (LACIE). The Experiment uses satellite data (LANDSAT and eventually NOAA environmental satellites) and surface meteorological data in a coordinated manner to explore new ways of estimating wheat production. Initial systems development and test is on North American winter and spring wheat crops. A major part of the current NOAA-LACIE effort is to develop weather-wheat yield models. Where the data are reliable, yield estimates derived from these models are already comparable to official USDA wheat yield estimates produced by conventional methods, when areas as large as several states are considered. In October of this year, LACIE is scheduled to begin tests to determine the capabilities to go global in scope. Wheat production (acreage and yield) will be determined in sample areas in several wheat producing countries. At each stage of the experiment, NOAA results are provided to Department of Agriculture and NASA for study and evaluation.

The yield modeling research is being led by NOAA's new Center for Climatic and Environmental Assessment, established in November 1974. The Center is rapidly developing two important applied climatological capabilities: (1) assessing impact of weather events on major crop areas as a particular growing season proceeds, and (2) interpreting long-term impacts of growing season weather in terms of variability of future yields. Most of the Center's applied research is being carried on in Columbia, Missouri, while a room for providing briefings on current crop-weather situations has been set up in a NOAA facility in the Georgetown section of Washington, D.C.



U S DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

U S DEPARTMENT OF AGRICULTURE
Statistical Reporting Service

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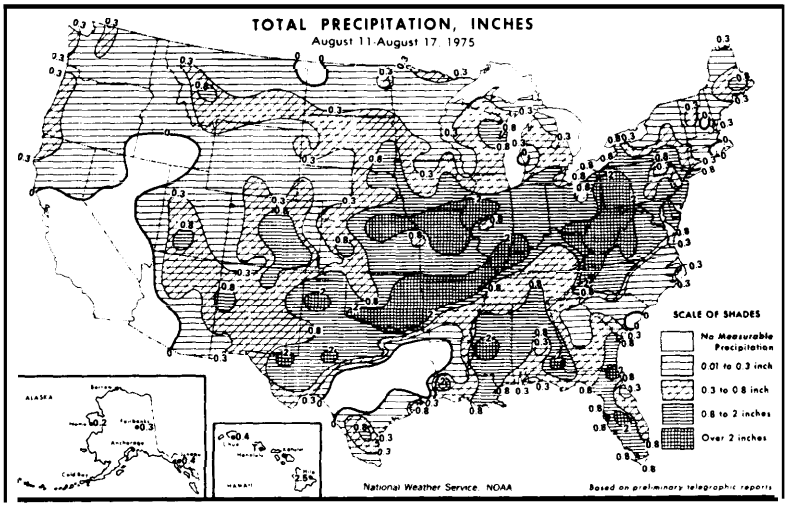


NATIONAL WEATHER SUMMARY

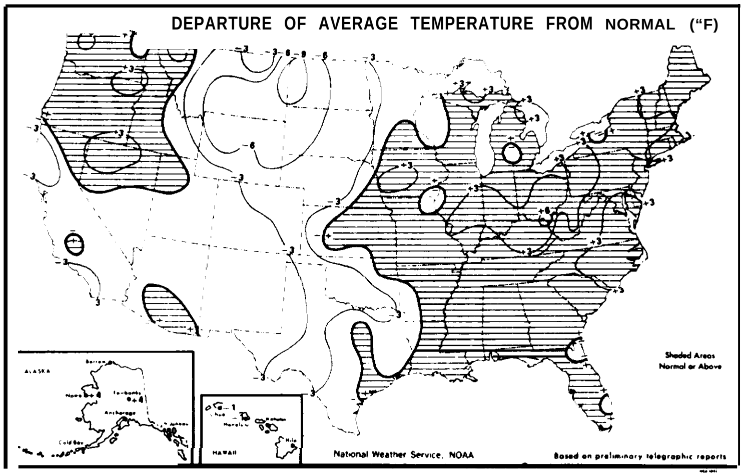
For the Week of August 11.17

HIGHLIGHTS: A slow moving cold front made the news when it broke the hot, dry spell over the Plains and upper Mississippi Valley. Significant rains favored Iowa and spilled over into Missouri. By the end of the week the frontal system stretched eastward, targeting its heaviest rains on the Northeast, central, and Southeast portions. Near normal temperatures dominated most of the Nation, but cooler readings across the northern Plains reflected movement of the weather system eastward

PRECIPITATION: All eyes were still turned to the central Plains on Monday, as dry conditions persisted there. A few scattered showers turned up in Iowa, but had little effect. In Kansas City, Mo., only 0.25 in. of rain had fallen in 50 days. Other areas, of course, got more than their share. Thundershowers sprang up along the Atlantic and Gulf Coasts, and gained momentum in the Ohio and middle Mississippi Valleys and throughout the southern Great Lakes States. To the West, showers dotted southern portions of the Rockies and Plateau regions. Otherwise, fair weather sprawled across areas from the northern Pacific Coast to the upper Mississippi Valley and from the southern Plains into the southern Appalachians.

An early morning rash of thunderstorms broke out on Tuesday in the central and southern Intermountain regions and deserts and high mountains of California. At the same time, a band of storms assembled in southwest Texas. By afternoon, showers had staked a bigger claim, and also covered an area from the western Great Lakes into the middle Missouri Valley.

It took a while, but substantial rains finally reached the parched Midlands on Wednesday, to lend a hand to those crops that still held on. A slow moving cold front drifting south and east



through the Plains and upper Mississippi Valley touched off storms, mostly in upper Michigan through southern Wisconsin and northern Illinols and across Iowa and southern Nebraska into northern Kansas and eastern Colorado. In the central and southern Plains, afternoon thundershowers kicked up locally heavy rains that continued into the evening hours.

Even though the frontal system drifted slowly east and west on Thursday, rainfall still held its ground against the hot, dry weather in the central Plains. Scattered activity persisted across the northern, west, central, and southwestern Plains. By noontime the front had taken up residence in the upper and middle Mississippi Valley. Scattered showers stretched across the central Gulf States and from the middle Mississippi Valley to the middle Atlantic Coast.

On Friday, rainfail shifted eastward. Thundershowers covered areas from the middle Atlantic States across the Appalachians into the Ohio and Tennessee Valleys. Meantime, more showers turned up along the central and southern Gulf Coast, southern Plains and extended from the northern Plains into the northern Rockies. Otherwise, dry weather dominated the New England States, Midwest, and far western parts of the Country.

Weekend showers were accompanied by isolated severe weather around the Nation. Showers and thundershowers stayed on in the upper Mississippi Valley, following the front from southern New England down the Ohio Valley, through southeast Oklahoma, and into southwest Texas. The coast was clear, along the south Atlantic, except for a few thundershowers in Florida that were accompanied by damaging winds. Fair conditions reigned over much of North Central and Southwest U.S., interrupted by some isolated showers in the northern and central Rockies. General rains spread from the Pacific into western Oregon and northern California. Strongest act i\. i ty , however, focused on the Northeast , Southeast , and centra 1 parts of the Nation.

TEMPERATURE: Readings in the 100's that are so common in the desert Southwest turned up on Monday in Kansas and Missouri as well. Warm weather shoved the mercury into the 80's and 90's across much of the Nation. The Pacific Coast noted temperatures in the 60's and 70's, and a few 70's dotted the northern Appalachians and upper Great Lakes areas.

Warm conditions across the western half of the Nation eased a bit on Tuesday. Readings in the 90's took some of the edge off the 100° heat in the desert Southwest and Middle Plains. In the northern Plains afternoon temperatures in the lower 70's reflected movement of the cold front southward into the central Plains and east to the Missouri Valley.

As a high pressure center trailed the cold front across the northern High Plains, Wednesday morning temperatures dipped into the 40's and 50's. Later on, some cooler readings also turned up in areas from the northern and central Rockies to the upper Great Lakes.

Thursday's temperature pattern in the central and northern Plains again testified to the arrival of cooler air there, with readings in the 60's and 70's. Cooler, but not unusual, temperatures in the 50's and 60's dominated the north and central Pacific Coast. For the rest of the Nation, it was more like summer, ranging in the 80's and 90's.

Friday set the pace for a near normal weekend, temperature-wise, across most of the Nation: some 50's in the mountains and along the Pacific Coast; low 100's in desert areas; and 90's over the southeast quarter. The northern Plains held out as the exception. From Montana to upper Michigan, afternoon highs stopped in the 60's and 70's.

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NATIONAL AGRICULTURAL SUMMARY

For the Week of August 11-17

Highlights: Beneficial rain was received over much of the Corn Belt aiding row crop development, however moisture shortages are still causing stress in northern portions of the North Central area. Corn and soybeans continue to progress ahead of both 1974 and normal in most States. Spring wheat harvest made excellent progress as combining passed the one-third mark.

SMALL GRAINS: Harvest of small grains continued to make good progress, but behind last year's excellent pace in nearly all areas.

Winter wheat combining edged closer toward windup as favorable conditions prevailed in the northern States, the only areas with acreage not yet harvested. As of August 17th, 91% of the crop was harvested, much behind last year's excellent progress. Rains interrupted combining in Montana.

Spring wheat harvest advanced rapidly in most major States and by August 17th, 35% of the 1975 crop was harvested, much behind 1974 level. Combining was nearing completion in South Dakota, 46% done in Minnesota, 24% in North Dakota, and 5% in Montana.

Oat harvest continued to move northward with 80% of the Wisconsin crop harvested. 75% in both Michigan and Minnesota, and 36% in North Dakota.

Preparation of fields for seeding this fall's wheat was ahead of usual in Illinois and Indiana, but behind schedule in Ohio.

CORN: Rains eased stress in many parts of the Corn Belt during the week, but above normal temperatures kept topsoil moisture supplies short in much of the area.

In the North Central States, corn development continued to progress at a steady pace ahead of last year and normal in nearly all States. Corn was in mostly good to excellent condition in Illinois, while growing conditions in Iowa were only fair. In Illinois, 53% of the crop was in the dent stage versus only 5% in 1974 and 19% average. Iowa corn was 30% in the denting stage, double the 1974 rate. 30% of Indiana crop was also dented or beyond, while 20% of Ohio corn had reached this stage. Corn on light soils in Wisconsin was still under severe stress and dry weather in Minnesota continued to diminish prospects.

Corn development in Kentucky equal 1974 and was slightly ahead of average, while in Tennessee development was ahead of 1974 and behind average.

COTTON: Cotton continues to make favorable progress in most major States, however insects are heavy in many areas and are causing damage.

Cotton in the Texas Blacklands and South Central was rapidly reaching maturity. Harvest was delayed in the Coastal Bend and Lower Rio Grande Valley, but resumed by the weekend. In Mississippi, cotton was in fair condition and 93% of the crop had set bolls. Heavy insects continued in Arkansas, but most fields were past peak. The Oklahoma crop was 54% setting bolls, 88% in Tennessee 9?% in Alabama and 95% in Louisiana.

Cotton was in fair condition in New Mexico and only a small percentage of the bolls were opening. California's late crop was blooming and setting bolls.

FRUITS AND NUTS: Peach harvesting was active in several Northern States and nearing completion in most southern areas. Early apples were sizing well and harvest gained momentum. Citrus trees in Texas benefitted from recent rainfall and groves were in excellent condition in Florida. Pecans were in fair to good condition in Georgia but yellow aphids and webworms were causing problems in Rolling Plains, Texas. Almond harvest was underway in California. In Oregon, the walnut and filbert crops look good.

VEGETABLES: Sweet corn and snap bean harvests continue in New York. Tomato harvest was heavy in Maryland, Pennsylvania, Virginia and Michigan. In Washington, broccoli, bush bean, cauliflower, cucumber, melon, sweet corn and tomato harvests continued. Cantaloup harvest was in full swing in California, but harvest of broccoli, cauliflower, carrots, and lettuce was slower. Carrots, cucumbers, cantaloups, onions, peas, and watermelons were being harvested in Texas. Land preparation was active in Florida for September plantings.

PASTURES AND LIVESTOCK: Pastures and ranges continued to deteriorate throughout much of the Nation except the South Central where above normal precipitation continues to aid new growth. Stock water is getting short in several areas of Arizona, California, and Utah, while fire danger is increasing in several of the Western States. Cattle continue in mostly good condition throughout most of the Nation and supplemental feeding was minimal.

SOYBEANS: Prospects for this year's soybean crop are more encouraging as rain fell over much of the major growing area during the past week. Development of the crop continues ahead of 1974 and normal in most States.

In the North Central States, soil moisture is still rated short in many areas, however, recent rains will aid in pod filling. Pod setting in both Illinois and Iowa reached 92%; 10% of the crop had leaves turning yellow in Illinois and 8% in Iowa; all stages were much ahead of both 1974 and average. Elsewhere in the Region, pod setting ranged from 68% in Missouri to 95% in Minnesota.

Soybeans improved in Kentucky and were good to excellent in Tennessee. In Mississippi, 45% of the crop was podding and in Arkansas early beans were blooming and setting pods, while late beans were blooming.

OTHER CROPS: Sorghum harvest in Texas at 48% continued ahead of both 1974 and average. Development of this year's crop was ahead of normal and 1974 in most major States.

Flue-cured tobacco was 95% harvested in Georgia, 88% in South Carolina, 54% in North Carolina and 27% in Virginia. Rains aided the crop in Kentucky, where 33% of the Burley crop has been topped. Tobacco hill, V< ‹ t s t., ited in Tennessee, but uneven growth was ... progress.

Potatoes in Aroostook County, Maine are growing slowly and substantial rains will be needed to aid yields before harvest. In Idaho, 20% of the fields were turning color, much behind last year's 40%.

White mold is causing concern to peanut growers in several States. The crop continues in mostly good condition in most areas.

Temperature and Prec ipitation Data for the Week Ending Midnight, l.s.t., Aug. 17, 1975

States and Stations	Temperature °F Average	Temperature °F Departure	Precipitation Inches Total	Precipitation Inches Departure
ALA.Birmingham	80	0	1.3	+ .3
Mobile	83	+ 1	,5	-1 0
Montgomery	83	+ 2	T	7
ALASKA, Anchorage	--	---	---	----
Barrow	--	---	---	---
Fair banks	60	+ 4	.3	.2
Juneau	55	0	4	,7
Kodiak	--	---	---	----
Nome	54	. 4	.2	- .6
ARIZ .Flagstaff	63	- 1	,5	- .1
Phoenix	90	+ 1	T	.3
Tucson	84	0	T	.6
Winslow	74	- 2	3	.1
Yuma	91	- 2	0	,1
ARK .Fort Smith	80	- 2	2.8	+2 2
Li ttle Rock	81	0	,5	1
CALIF.Bakersfield	85	+ 3	0	0
Eureka	54	- 3	.4	.3
Fresno	76	- 2	0	0
Los Angeles	71	- 3	0	0
Red Bluff	77	- 3	2	+ .2
San Diego	69	3	0	0
San Franc isco	61	2	T	0
Stockton	73	2	0	0
COLO. Denver	68	4	1.7	● 1.4
Grand Junction	74	2	.1	,2
Pueblo	74	1	1.8	+1.3
CONN .Bridgeport	76	+ 3	,4	.5
Hartford	74	3	.1	.6
D. C. Washington	81	+ 3	1.1	0
FLA.Apalachicola	62	0	4	-1 4
Dayto na Beach	81	0	3	-1 2
Ft. Myers	W34	1	9	.8
Jacksonvil le	80	1	2,0	, .2
Key West	85	0	.4	.5
Lakeland	82	0	5.1	+3.5
Miami	S3	0	1.9	+ 4
Orlando	S2	0	6	.9
Tallahassee	82	1	,9	.6
Tampa	83	0	.8	-1.0
W. Palm Beach	81	- 1	,5	-1,0
GA .Atlanta	79	+ 1	T	, .8
Augusta	81	1	.6	- .4
Macon	81	0	.2	- ,6
Sava nnah	82	+ 1	1.0	- ,4
HAWAII .Hilo	76	0	1.5	- .1
Hon olulu	80	- 1	T	- ,2
Kahului				
Lihue	76	- 1	.4	- .1
IDAHO. Boise	73	0	.1	0
Le. iston	75	+ 3	T	- .1
Pocatello	69	- 1	T	- .1
ILL. Cai ro	80	0	3.0	+2,2
Chicago	76	+ 2	.3	- .4
Mol ine	75	+ 1	.7	0
Peoria	75	+ 1	2,3	+1.7
Rock ford	74	2	.6	- .2
Spri ngfield	76	+ 3	4	- ,2
IND.Evansville	78	1	2.3	+1,6
Ft Wayne	73	1	1.S	+1.2
Indianapolis	77	+ 3	1.4	+ .8
South Bend	74	2	1.5	+ .7
10wA.Burlington	74	1	1.9	+2.1
Des Moines	77	+ 9	.5	- .3
Dubuque	72	1	2	- ,7
Sioux city'	73	- 1	1.3	+ .6
KANS .Concordia	79	1	2.4	+1,7
Dodge Ci ty	80	1	.1	- .5
Goodland	72	3	.3	- .2
Topeka	80	2	.0	0
Wich ita	80	1	.2	+ .5
KY. Lexington	79	3	.3	- ,5
Louisville	80	4	1.6	+ ,9
La.Baton Rouse	82	0	.5	- .5
Lake Charles	83	1	.4	.7
New Orleans	82	0	1.0	- .1
Shreveport	82	2	0	- .6
MAINE .Caribou	68	+ 5	.2	- .6
Portland	70	+ 3	.2	- .4
MD. Baltimore	79	4	1.3	+ .3
MASS .Boston	75	3	.1	.7
Chatham	70	. -	0	----
MICH .Alpena	68	3	T	- .6
Detroit	73	2	.5	- .3
Flint	71	2	.2	.6
Grand Rapids	71	0	.1	- .4
Houghton Lake	67	+ 1	.3	- 2
Lansing	69	1	.6	0
Marquette	69	3	.2	- .5
Muskegon	71	1	T	.s
S. ste. Marie	66	2	.2	.5
MINN.Duluth	63	2	1	8
Internatl Falls	63	1	4	- .4
Minneapolis	71	0	.1	- .6
Rochester	70	0	.2	.6
St . Cl Gad	67	2	.1	- .8
MI SS.Jackson	82	+ 1	1.0	+1.2
Meridian	82	, 1	.7	.8
MO. Colombia	77	0	1.1	*1.4
Kansas City	80	, 2	.5	.3
St . Louis	81	, 3	.6	+1 o
Springfield	78	0	9	+ .3
MONT.Billings	64	7	3	1
Glasgow	69	1	1	3
Great Falls	64	4	T	.2
Havre	65	- 4	.2	0
Helena	2	5	.8	6
Kalispell	6	, 3	.2	.1
Miles city	66	8	.6	+ 3
Missoula	66	2	.1	.1
NEBR. Grand Island	71	5	.5	.1
Lincoln	77	0	.0	+ .3
Norfolk	73	2	.7	* .1
N. Platte	71	3	.3	.2
Omaha	78	+ 3	.8	.1
Valentine	70	4	.2	.4
NEV .Ely	65	1	T	.1
Las Vegas	87	1	o	,1
Reno	68	1	T	.1
Winnemucca	73	5	T	.1
N. H. Concord	70	2	T	.6
N.J.Atlantic City	75	1	.5	+ .3
Trenton	76	, 2	,7	.3
N.MEX.Albuquerque	75	2	.7	.4
Roswell	77	2	.7	+ .3
N. T. Al bany	71	1	.1	.5
Binghamton	66	o	.7	.9
Buffalo	72	3	.6	+ .8
New York	76	, 1	.8	.3
Rochester	69	1	.3	.4
Syracuse	70	0	.1	.7
N .C. Asheville	74	+ 1	.3	+ .2
Charlotte	80	+ 2	.9	0
Greensboro	81	+ 4	.8	.2
Hatteras	81	+ 3	.4	+1.1
Raleigh	80	+ 3	.1	+1.0
Wilmington	84	+ 4	T	1.5
N .DAK.Bismarck	64	- 6	.2	- .3
Fargo	67	- 3	.2	- .5
Williston	61	- 9	T	- .4
OHIO. Akron-Canton	74	+ 3	.8	+ .2
Cincinnati	78	+ 3	1.1 1	+ .5
Cleveland	73	+ 2	.9	+ .2
Columbus	77	+ 4	1.2	+ .6
Dayton	75	+ 1	1.5	+ .9
Toledo	72	+ 1	.8	+ .1
Youngstown	72	+ 2	2.2	+1.5
OKLA.Okla . City	79	- 3	.5	- .1
Tulsa	83	+ 1	2, 1	+1.5
OREG.Astoria	61	+ 1	.1	- .2
Sums	68	+ 1	.1	0
Medford	71	0	.4	● .3
Pendleton	75	+ 3	T	1
Portland	68	+ 1	.3	+ .1
Salem	66	0	.5	+ .4
PA .Allentown	73	+ 1	1,2	+ .2
Erie	71	+ 3	.6	- .1
Harrisbu rg	76	+ 2	.7	0
Philadelphia	77	+ 2	1.2	+ .3
Pittsburgh	74	+ 3	2 3	+1.6
Scranton	72	+ 1	.2	- .5
R. I. Providence	74	+ 3	T	- .9
S.C. Charleston	81	+ 1	T	-1.5
Columbia	81	0	T	-1.3
Greenville	80	+ 2	.1	- .8
S.D. Aberdeen	69	- 3	6	+ .1
Huron	70	- 3	.5	0
Rapid Cit Y	66	- 7	.3	- .1
S 1oux Falls	70	- 3	1.6	+1.0
T2sw.Chattanooga	78	0	.4	.3
Knoxvil le	79	+ 1	.3	.4
Memphis	63	+ 2	4	. .4
Nashville	80	+ 1	4	.3
T S X .Abilene	82	- 2	1.2	, .8
Amarillo	75	- 3	2.8	+2.1
Austin	84	- 1	o	. .5
Beaumont	8S	0	T	.1.3
Brownsville	83	- 1	.1	. 4
Corpus Christi	64	- 1	0	.7
Del Rio	84	- 3	T	. 2
El Paso	80	- 1	3	0
Fort Worth	2s	+ 1	.1	. 4
Galveston	85	+ 2	1.5	. 5
Houston	82	- 2	.1	. .9
Lubbock	79	0	.5	1
Midland	80	- 2	1.4	1 0
San Angelo	81	- 4	.1	2
San Antonio	83	- 2	T	5
Victoria	85	0	T	- .7
Waco	86	0	0	.4
Wichita Falls	83	- 3	.8	.4
UTAH.Blanding	68	- 3	.1	.3
Salt Lake City	76	+ 1	T	.2
V T. Burlington	71	+ 3	.2	.6
V A .Lynchburg	77	+ 2	2.8	1.9
Norfolk	82	+ 5	.2	-1.2
Richmond	81	+ 4	1.0	.2
Roanoke	77	+ 2	1.5	.5
W A S S .Colville	--	---	---	---
Omak	70	+ 1	.1	0
Quillayute	59	0	.8	.2
Seattle-Tacoma	67	+ 3	.2	0
Spokane	6s	- 1	.1	0
Walla Walla	75	+ 1	0	.1
Yakima	71	+ 2	.1	0
W.Va .Beckley	72	+ 3	2.5	1.7
Charleston	74	0	3 5	2.7
Huntington	80	+ 6	3.3	2.5
Parkersburg	77	+ 3	2.0	1.2
WIS.Gree " Bay	69	+ 1	1.3	.7
La CT osse	71	- 1	T	.7
Madison	71	+ 1	.5	.1
Milwaukee	72	+ 2	.3	.3
WYO. Casper	66	- 5	.1	0
Cheyenne	63	- 5	.3	.1
Lander	64	- 6	.1	0
Sheridan	64	- 6	.2	0
P. R. San Ju. n.	82	+ 1	55	1.1

Based on 1941-70 Normals

There was an error in the July monthly table for Des Moines, Iowa. It should have read T for precipitation, departure '3 3 This error appeared in the August 12. Volume 62 No 32 . . preci pit. t ion 4, departure '2.9

The Weekly Weather and Crop Bulletin is published by the National Weather Service, NOAA, and statistical Reporting Service, USDA. Standard copy for the Bulletin is prepared by Dr. Richard E. Felch, agricultural climatologist, Lyle M. Denny, Orus W. Byrd, meteorologists, DeLon Brown, agricultural statistician, and Susan E. Atkins, editor.

STATE SUMMARIES OF WEATHER AND AGRICULTURE

These summaries provide brief descriptions of crop and weather conditions important on a national scale. More detailed data are available in Weather and Crop Bulletins published each Monday by SRS State offices in cooperation with the National Weather Service, NOAA.

ALABAMA: Scattered showers and thundershowers throughout with most numerous amounts concentrated over north. Greatest 24-hour rainfall total 2.35 in. at Louisville. Temperatures warmer than past several weeks with weekly average 1° above normal.

Shower activity decreased, making working conditions favorable in most areas. Soil moistures adequate. Corn condition good to excellent. 75% dented, same as 1974. Cotton condition fair to good 94% setting bolls, 100% 1974. Insect control underway. Soybean condition good with 84% blooming and 61% setting pods. Peanut condition still good, but diseases are still present. Hay harvesting in full swing as weather permits. Pasture condition remains good.

ALASKA: Tanana Valley west half warm and relatively dry, east half wet with normal tem- pe ratures. Kenai Peninsula near normal temperatures coasts, above normal inland. Kodiak Rainfall was twice the seasonal normal, temperatures were below normal.

Hay harvest continued at a slow pace with the frequent rainshowers. Hay quality from many fields have been reduced. Grain fields are mostly in the dough stage of development with several turning color. Harvest of grain is expected to begin shortly in the Fairbanks area but later in remainder of Railbelt. Ground moisture supply continued adequate.

ARIZONA: Temperatures near normal most regions, about 5° below normal Grand Canyon area. Spotty thundershowers early week. Virtually no rain after 13th.

Cotton mostly fair to good condition. Grain sorghum planting complete. Early plantings ready for harvest. Safflower harvest complete. Cochise County's fall beet, good condition. Alfalfa hay seasonal progress. Land preparations fall plantings central, southwest, south east. Fall cantaloups satisfactory. Yuma d. Shipments white grapefruit Maricopa County. Fruit sizing well south- west. Few mites, ore wind burn on dry trees. Ranges fair to good condition high regions, fair lower elevations. Rain needed soon southeast. Cattle mostly fair, stock water getting short.

ARKANSAS: Temperatures near normal. Departures ranged from .3 to +2°. Extremes: 101° at Gilbert to 61° at Gilbert. Precipitation was widespread with highest over north half. Greatest amounts were 3.75 in. at Fayetteville and 3.74 in. at Evening Shade. Over 1.00 in. at most stations.

Scattered shower activity improved soil moisture supply. Soil moisture mostly adequate. All crops in good condition. Fieldwork 5 days suitable. Cotton continuing heavily, most fields past peak, few open bolls. Rice crop maturing rapidly, harvest started on ca, 1 y va „ et ,,,, Early soybeans blooming, setting pods. 12 t c beans blooming, n<. < d 01 5 turei or 1 nere a-c ovegeta t 1 ve growth. Corn silage being harvested. Corn 1 01 g, a1 n near maturity. Early grain sorghum being harvested. Pastures supplying adequate forage, needs rainfall for regrowth.

CALIFORNIA: Nightly scattered thundershowers 1 1 t 1 on north and central, otherwise fair. Slight cooling [u] ring week. Highs in central valley over 100" beginning week. Coastal highs 50's north to 70's south. Averages slightly below normal coastal, slightly above northeast and near normal other areas.

Small grain harvest nearly completed. Rice good progress, heading out. Cotton blooming, setting bolls, late. Sugarbeet digging continues. Dry bean maturing rapidly, thrashing begun. Alfalfa cutting continues. Some armyworm damage . i1 1a11 a seed harvest gaining, yield c, own. Safflower harvest gaining. Pear, Gravenstein apple harvests underway north coast. Carol yn, Jungerman pt. ache= being harvested. Prune, almond harvests started Woodland, other areas this week. Late freestone market nectarines, plums being harvested. Some late, huskfly problems walnuts. Thompson, Cardinal, Exotic, Queen varieties grapes being picked, quality good. Wine grapes remain week behind. Valencia harvest continues slow, quality declining. Navel crop varies by area, scale showing up. Cool weather holding back lemon color. Poor avocado set Santa Barbara. Broccoli and cauliflower, carrots and lettuce light Salinas. Cantaloups full swing westside. Celery moderate central coast, honeydews continue San Joaquin Valley. Onions and potatoes good growth, early potato harvest begin next week Shasta Valley. Canning tomatoes progressing San Joaquin, beginning Sacramento. Watermelon continues central San Joaquin. Livestock remains good, supplemental feeding start in,: Water supplies co ... itical,

COLORADO: Temperatures slightly below normal. Highs 80's to 90's. Cold front 12th and 13th lowered temperatures 10 to 25°. High temperature was 100° at La Junta. Showers and thunderstorms mountains and in east. Heaviest totals 2.05 in. at Ft. Collins. Precipitation averaged over 1.00 in. east.

Corn average height 75 in., tasseled 95%, 96% average, 98% 1974, silked 94%, 93% 1974. Dry beans flowered, 9%, 83% 19; . Sorghum headed 50%, 47% 1974. Sugarbeets late with good growth, some hail damaged. All row crops good condition. Second cutting alfalfa 37% complete. Ranges and pastures improved, but remain dry southeast, mostly good elsewhere. Livestock good condition.

FLORIDA: Typical summertime weather near normal temperatures. Highs in low 90's. Scattered afternoon thundershowers entire State, amounts averaging 1.00 to 3.00 in.

Soil moisture adequate to surplus. Flooding continues Panhandle. Crop condition variable, considerable damage in Panhandle. Other areas most 1 y good. Field corn harvest continues. Peanut ● hard h 1t by white mold. Flue-cured tobacco harvest complete. Hay ... ing interrupted by showers. Soybeans damaged Panhandle, good condition elsewhere. Sugarcane good condition. Pastures mostly good condition. Cattle and calves good condition, citrus grove condition excellent. General rains continue some areas excessive moisture. Abundance of new foliage, new crop fruit progressing well. Land preparation active for September plantings of snap beans, cabbage, sweet corn, cucumbers, squash. Planting celery, eggplant, pepper, tomatoes underway. Early planting progressing well on all, rc,.

GEORGIA: Showery weather over the north ended midweek and only isolated afternoon thundershowers thereafter. West central, east central, and southeast averaged over 1.00 in., northern third averaged near 0.75 in. central was the dry spot with only 0.25 in. or less. Isolated thundershowers over weekend.

Soil moisture mostly adequate to surplus. Fieldwork very active, 4 days suitable. Corn mostly good to excellent. Silage harvest active. Peanuts mostly good, white mold a major concern. Cotton fair to mostly good, high insect populations, insecticide applications continued active. Soybeans mostly good to excellent, insects becoming a problem. Tobacco 95% harvested, average 96%, 1974 94%. Watermelons 97% harvested. Pastures, cattle, hogs good. Haying very active. Pecans fair to good, spraying active.

HAWAII: Beneficial rains fell in sections of Hawaii and Kauai. No relief in the dry Hamakua Coast of Hawaii.

Growing conditions favorable for crop growth. Spraying frequent to curb insect infestation. Vegetable supplies adequate. Melon production light. Banana supplies remain moderate to heavy. Papaya harvesting fluctuating. Pineapple late crop in full harvest. Sugar harvesting steady.

IDAHO: Temperatures near normal early week, below normal end of week. Scattered showers later part of week.

Harvesting operations highlighted week activity. Winter wheat 25% harvested, 60% 1974. Potato crop 20% fields turning color, 10% 1974, with 15% vines dying. Spring wheat harvest starting, 30% harvested 1974. Barley 25% harvested, 35% 1974. Range and livestock good condition.

ILLINOIS: Temperatures 1° below normal west, 1 to 2° below normal elsewhere. Precipitation 0.33 to 0.75 in. north, showers up to 3.00 in. south. Corn mostly good to excellent condition dough 88%, 45% 1974, 61% average; dent 53%, 5% 1974, average 19%. Soybeans mostly good to excellent. Setting pods 92%, 4(V 1974, average 62%, 1 O? turning yellow, 0% 1974, average 1%. Alfalfa hay mostly fair to good. 3d crop 28% cut, 22% 1974, average 13%. Winter wheat plowing complete 46%, 1974, average 14%. Pastures mostly fair to good. Soil moisture 2% short, 53% adequate, 5% surplus. Fieldwork: 5 days suitable.

INDIANA: Humid, hot week with numerous showers. Rainfall averaged from 1.10 in. southeast to 1.80 in. northwest. Temperatures ranged from 54 to 95°. Many stations recorded highs in the 90's. Minimum temperatures and humidity well above normal.

Fieldwork available 5 days. Topsoil and subsoil moisture mostly adequate. Corn 95% silked, 1974 5%. Corn in dough and beyond, 30%, dent, 1% and 3% mature. Soybeans 80% setting pods, 1974 15%. Wheat stubble 30% plowed, 1974 25%, average. Apples 20% picked. Peaches 50% picked. Alfalfa hay, 90% cut second, third. Pastures poor to mostly fair.

IOWA: Temperatures 2° above normal, except near normal southeast. 1° below normal northwest. Rainfall averaged heavy since June, in northwest to southeast across State. Many amounts over 1.00 in. Few amounts 3.00 in. Northwest, southeast, continued ... .

Scattered heavy rains throughout week beneficial to soybeans and corn. Severe weather resulted in hail and wind damage. Some corn green chopped, cut for silage. Corn 0% in dough stage, 54% 1974, 62% average, 30% in dent stage, 15% 1974, 20% average. Growing condition mostly fair. Rains will aid filling of soybean pods. 92% setting pods, 78%

1974, 81% average, 8% leaves turning, well ahead of 1974 and average, growing condition fair to good. Third cut alfalfa 11% harvested and considered short. Second cut red clover hay 70% harvested. Pastures poor, but expected to green up with rains. Topsoil moisture 85% short, 15% adequate. Subsoil moisture 86% short, 14% adequate. Fieldwork averaged 5.6 days suitable.

KANSAS: Temperatures averaged near normal. Beneficial to substantial rains occurred over most of the dry areas of the north and east on 13th. Scattered showers and thunderstorms many areas last half of week. Southwest and south central still dry with generally less than 0.50 in. rain.

Good rains northwest, north central and eastern third improved soybean and sorghum prospects. Corn 75% in dough stage, same as 1974 70% average: 30% in dent, 35% 1974 and average. Sorghum 55% headed, same as average, 45% 1974. Soybeans setting pods 60%, 50% 1974, 65% average. Alfalfa third cutting, 55%, same as 1974, 60% average.

KENTUCKY: Warm and humid weather with daily scattered thundershowers prevailed throughout. Temperatures averaged slightly above normal. Rainfall averaged 0.75 in. with isolated amounts around 2.75 in.

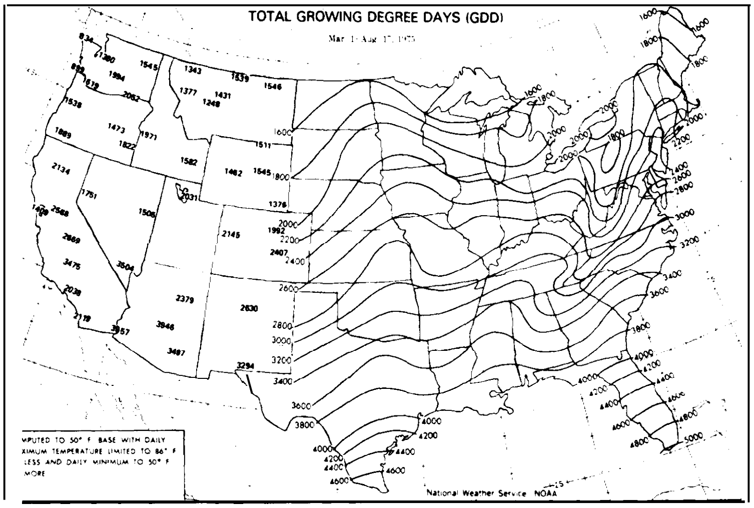
Farmers busy clipping pastures, baying, spraying and topping tobacco and getting reach ...ready for harvest. Over 5 days favorable fieldwork despite showers. Soil moisture mostly adequate, some shortages central counties. Corn 68% dough or dent, same as 1974 and slightly ahead of average. Soybeans improving, 36% podding, 45%; 1974, 46% average. Tobacco greening and growing again. Burley 33% topped, compared 53% 1974, 60% average. Dark types half topped. Burley cutting expecting to start next week. Third cutting alfalfa 58% finished. Pastures improved.

LOUISIANA: Temperatures 2° below normal north, near normal South. Scattered thundershowers southeast, measurable rain 2 to 5 days. Isolated thundershowers elsewhere. Temperature extremes 98° Alexandria 12th through 15th, 67° Island 11th. Greatest 1-day rainfall 2.05 in., Dequincy 13th.

Soil moisture surplus southeast, adequate elsewhere. Fieldwork possible 4.1 days. Main activities cultivating late soybeans, rice and sweetpotato harvest, insect control, and haying. Soybeans fair to good: insecticide and fungicide application increased; early beans setting pods; late beans blooming. Cotton fair, 95% setting bolls, insect control increased. Weevils and tobacco budworm more numerous. Rice mostly good, 34% harvested, 54% 1974, 24% average, yields good: later rice heading. Corn good, light harvest. Sorghum mostly fair: insecticide application increased. Sugarcane good, growing rapidly; ... station ... to heavy. Fallow plowing where possible. Sweetpotatoes fair to good, 15% harvested. Hay harvest in full swing. Pastures average. Cattle mostly good.

MARYLAND AND DELAWARE: Temperatures averaged normal. Highs upper 80's and lows upper 60s. Precipitation 1 11 ! < normal thundershowers occurred midperiod.

Corn rated good to excellent 60% in dough stage and 31 in dent stage, 65% 26% 1974. Soybeans 1%, 65% bloomed 31 podded, 73% 27% 1974. Tobacco harvest 15% complete. Some fields late and poor ... 11. > 3rd cutting alfalfa 0 3% complete. Second cutting clover and ... mixtures 85% complete. Cantaloupes 90% harvested, watermelons 75%, peppers 60%. Green tomato harvest complete, red



MICHIGAN: Temperatures normal south and Upper Peninsula, 2° above elsewhere. Scattered showers light to moderate.

Corn 70% dough, 15% 1974. Soybeans 70% setting pods, equals 1974. Dry beans 80% setting pods. Pinto bean harvest active. Potato digging 30% Saginaw Bay. Oats 75% harvested, 60% 1974. Pasture feed supplies below average. Second cutting alfalfa hay 75% done. Peach harvest speeding up, Red Havens peak. Summer apples 40%, cantaloup in southwest. Sweetcorn 50%, cucumbers 60% harvested. One-third tomatoes picked. Fieldwork: 5.4 days favorable. Soil moisture short in Upper Peninsula, short to adequate elsewhere.

MINNESOTA: Cooler with scattered light showers. Temperatures 1 to 2° below normal east to 3° below west. Extremes: 100 and 37°. Rainfall averaged 0.40 in. central and southwest, 0.20 in. elsewhere. Frost and freezing temperatures Roseau area morning of 18th.

Dry weather continued to diminish row crop prospects. Lack of rain has prompted some farmers to commence cutting corn for silage. Pastures dormant furnishing only limited amount feed. Small grain harvest proceeding rapidly. Rye and winter wheat harvest essentially completed. Oats 75% combined, average 62%; barley 77% combined, average 60%; other spring wheat 46% combined, average 35%. Corn 34% dough, average 23%; one-third poor condition balance fair to good. Soybeans 95% setting pods or beyond, average 86%, 20% poor condition balance fair to good. Flax 17% combined, average 19%.

days suitable. Cotton 93% setting bolls, 95% 1974. Soybeans 74% blooming, 70% 1974, 68% average; 45% podding, 47% 1974, 45% average. Corn 94% tasseled, 94% 1974. Rice 31% and sorghum 74% headed. Watermelons 88%, hay crop 53%, sweetpotatoes 19%, corn silage 30%, and sorghum silage 21% harvested. Cotton mostly fair condition. Soybeans mostly good condition.

MISSOURI: Temperatures averaged 2° above normal, ranging from normal west central plains to 3° above normal northwest. Precipitation increased over State, ranging from 0.75 in. east Ozarks to 1.25 in. west.

Dry conditions prevail with soil moisture short except Bootheel area. Corn 75% in dough stage, 61% 1974, 67% average; condition mostly poor to fair. Soybean condition mostly fair, 68% setting pods, 40% 1974, 50% average. Grain sorghum 80% headed, 66% 1974, 77% average. Cotton mostly fair to good condition.

MONTANA: Temperatures warm early week with cooling by 17th. Temperatures averaged a little above normal west to 9° below normal south central. Highest maximums mostly 80's and lower 90's. Precipitation above normal most areas, with substantial central rains.

Winter wheat 30% harvested, delayed by rains and green spots some areas. Spring wheat 5% harvested, 20% ripe, 60% turning, 15% headed but still green. Barley 5% harvested, 20% ripe, 50% turning, 25% headed but still green. Second cutting alfalfa 35% complete, wild hay 70% complete.

Grasshopper damage to crops and ranges mostly light to moderate, some heavy damage south central. Stock water and range feed supplies generally adequate. Ranges normal to above normal.

NEBRASKA: First day of period temperatures above normal, otherwise, cool temperatures prevailed.

Topsoil moisture supplies 58% short, 42% adequate. Subsoil moisture supplies 74% short, 26% adequate. A year ago topsoil 64% short, subsoil 83% short. Irrigated corn condition mostly good to excellent. Dryland corn condition fair to good. Corn 70% in the dough stage. Sorghum condition fair to good, over 90% headed, 75% 1974. Soybean condition mostly good, over 80% podded, 70% 1974. Alfalfa hay mostly fair, over 40% third cutting harvested. Sugarbeets and dry beans continue to look good. Pasture and range feed supplies 67% short and 33% adequate.

NEVADA: Temperatures near normal. Lightning from thunderstorms north started numerous brush fires. South remained hot and dusty. Extremes 107° Logandale, 34° Battle Mountain.

Small grain harvest well along north. Garlic harvest nearing completion. Second cutting alfalfa well along Northern Valleys. Livestock mostly good condition.

NEW ENGLAND: Rainfall light, scattered thundershowers. Warm weather all week.

Harvest early apples, peaches, pl ures underway in New England. Aroostook, Me. Potato crop growing s 1<)* 1\. Final yields depend substantial rain before harvest. Silage corn better than normal. Second and third cutting hay active.

NEW JERSEY: Temperatures averaged 2° above normal. Extremes 52° at Canoe Brook on 12th and 92° at Bridgeton on 14th. Weekly rainfall averaged 0.45 in. north, 1.24 in central and 1.36 in. south. Heaviest 24-hour total was 3.02 in. at Glassboro on 15th to 16th. Estimated soil moisture, in percent of field capacity averaged 63% north, 69% central and 67% south.

Soil moisture adequate with a few areas in need of rain. Small grain harvest virtually complete. Haymaking progressed well. Vegetable and Irish potato harvest in full swing. Harvest of summer variety apples nearing completion. Peach harvest about 50% complete. Blueberry harvest virtually complete.

NEW MEXICO: Thundershowers somewhere almost daily with greatest rainfall totals northern mountains. Temperatures averaged near to about 3° cooler than normal.

Moisture short, ranges fair, livestock good. Cotton fair, bolls setting, small percentage opening two weeks late. Alfalfa fair to good start 3d cut north, well advanced 4th cut south. Grain sorghum mostly good, well advanced heading. Initial greenbug control ineffective in 3 counties. Corn good, near completion tasseling, some areas in dough stage. Land preparation for winter wheat.

NEW YORK: Temperatures 1 to 3° above normal except St Lawrence Valley at 7° above. Spotty rainfall averaged about 0.50 in below normal most areas but Buffalo and Binghamton had 1.00 in above.

Second cutting alfalfa 75% complete, 3d cutting 10%. Oats nearly 50% harvested. Wheat harvest nearly complete. Corn Co, >dt(, excellent condition some in dent stage. Pastures fair condition. Kraut cabbage harvest underway. Sweet corn and snap bean harvest continues. Early McIntosh harvest underway. Grapes in good condition, ahead of normal maturity.

NORTH CAROLINA: Near normal temperatures for week, but below normal precipitation. Temperatures began below normal but by midweek were well above normal and continued into weekend. Precipitation was light but scattered thunder showers late on 17th brought needed rains to much of State.

Days suitable fieldwork 5.0. Soils became drier, 16% very short, 49% short, and 35% adequate. General rains need statewide. Overall condition of crops unchanged. Flue-cured and burley tobacco fair to good. Flue-cured harvest 54% complete, 1974 55%, average 48%. Cotton improved, mostly good. Corn, hay and Irish potatoes slightly down, fair to mostly good. Peanuts, soybeans, sweet potatoes, and apples mostly good. Limited sweetpotato digging. Pastures need rain, mostly fair to good.

NORTH DAKOTA: Temperatures near normal. Extremes 94° at Watford City, 49° at Pembina. Precipitation below normal. Most precipitation for week 0.76 in. at Bowman. Weekend near normal daytime temperatures and cool nights with scattered showers.

Harvesting small grains progressed well with 24% hard spring wheat harvested, 31% 1974, 27% normal. Durum was 13% combined, equally 1974 and normal. Oats 35% and 33% barley combined. Rye and Winter wheat nearing completion. Scattered showers gave little relief to row crops and small grains. Livestock generally good condition with pastures needing rain.

OHIO: Above normal temperatures early week then cooling in northern areas 15th and 16th. Temperature extremes 95 and 59°. Showers and thunderstorms throughout week. Greatest rainfall =x, theast 3.62 in.

Harvest completed. Potatoes 25%, 25% 1974 and normal, alfalfa hay 3d cutting 20%, 10% 1974 and normal, clover-timothy 2d cutting, 85%, 80% 1974 and 70% normal. Corn 80% in dough stage, 50% 1974 and 55% normal; 20% dented, but not hard, 15% 1971 and normal. Soybeans 50% pods set, 25% 1974 and 40% normal. Fall plowing for wheat 25%, 20% 1974 and 30% normal. Tobacco 25% topped 35% 1974 and normal. Moisture supplies 19% short, 70% adequate 11% surplus. Over 4 days favorable for fieldwork.

OKLAHOMA: Temperatures averaged from 2° below normal to 2° above normal. Precipitation averaged from 0.1 in south central to 2.16 in northeast. Weekend very warm with rain most areas.

Field crop conditions mostly good to fair. Rainfall needed for wheat seedbed preparation, 22% complete. Surface soil moisture 43% short, 49% adequate 8% surplus. Subsoil moisture 32% short, 68% adequate. Corn 70% dented, 10% mature, 46% 1974 20% average. Sorghums 86% headed, 53% dough stage 7% mature 8% 1974. Cotton acreage 100% squared, 54% setting bolls 77% 1974. Peanuts good, 63% spiked, 70% 1974. Soybeans virtually complete flowering stage 39% podding, 34% 197.~ Alfalfa 3d cutting 77% complete, seed prospects mostly fair due to heavy rains. Range and pasture conditions mostly good, continued to decline statewide.

OREGON: Temperatures near normal. Maximums 80 and 90 interior, 60s and low 70's along coast. Minimums in 40 and 50. Precipitation west 0.01 in. or less. No precipitation east.

Fall grain harvest 75% complete, yields good. Second and third cutting hay continuing. Mint hops good. Grass seed harvest nearly finished. Bartlett pear harvest about to begin, good crop. Cherry harvest almost completed. Peaches being picked. Walnuts, filberts good. Evergreen blackberries being picked. Cauliflower, sweet corn, broccoli, beets, green beans, cucumbers being harvested. Most potatoes good except in Klamath County where scattered freeze damage occurred, [illegible]. Lower, middle elevation ranges dry. Higher [illegible] in good condition. Cattle and calves in good shape. Feed, range water adequate. Fire danger increasing.

PENNSYLVANIA: Warm and very humid most of week. Weekly temperatures averaged 2 to 4° above normal south and west, near normal elsewhere. Extremes: 91 and 49°. Showers and thundershowers throughout week produced 0.10 to 0.50 in. rainfall north to more than 2.50 in. parts southwest and south central. Elsewhere mostly 0.75 to 1.25 in.

Crop prospects improved by rain. Major activities combining oats and baling straw, harvesting early potatoes, apples, peaches, pears, plums, tomatoes, sweet corn, tobacco and fall plowing. Preparations for silo filling underway. Oats 75% combined, tobacco 5% cut, potatoes 20% dug. Corn for grain 16% silked, 42% dough, 3% dented. [illegible] harvested. Alfalfa hay 2nd cut [illegible] complete, 3rd cut 21%, [illegible] 2nd cut 51%. Fall plowing 12% complete. Pastures providing average to below average feed. Grape crop looking good. Apples sizing well, harvest of early varieties underway. Peach harvest in full swing. Cabbage harvest underway in Ringtown Valley area. Quality and quantity of sweet corn and tomatoes for fresh market good.

PUERTO RICO: Island average rainfall 2.29 in. Highest weekly total 6.17 in. at Pico Del Este-Luquillo. Highest 24-hour total 3.70 in. at [illegible] airport. Temperatures averaged 81° on coast and 75° interior. Extremes 93 and 58°. [illegible]

SOUTH CAROLINA: Cooler than normal early, rising to above normal late week when some of the hottest weather of summer occurred. Rainfall mostly below normal. Showers locally, widely scattered showers [illegible] of week. Heaviest thundershowers mostly in south.

Growing crops are in need of rain [illegible], crops are in good condition. Tobacco 88% harvested, 90% 1974, 8[illegible] average. Cotton fair to good condition, infestation of bollworms and weevils heavy, 95% setting bolls, 6% open bolls. Soybeans good condition, [illegible] blooming, 39% setting pods. Corn condition good, 55% mature stage. Peaches 96% harvested, 97% 1974, 93% average.

SOUTH DAKOTA: Temperatures averaged 1 to 7° below normal. Extremes: 97° Gregory and White Lake [illegible], 38° Rapid City. Precipitation ranged from 0.[illegible] in. northwest to 1.18 in. east. Precipitation departure from normal for the growing season [illegible] 1.58 in. below normal northeast to 3.[illegible] in. above normal.

[illegible] 12% harvested, 1974 1[illegible]%, normal 42%. Corn 33% in dough stage, 1974 19%, normal 41%. Soybeans 93% podded, slightly ahead of 1974 and normal. Sorghum 67% headed, 1974 64%, normal 72%. Cutting corn for silage has started. Discing stubble and fall plowing are under way. Livestock in good condition. Pastures are generally adequate but grass is getting tough as it matures. Stock water supplies are generally adequate except central and northeast where supplies are short.

TENNESSEE: Temperatures averaged 2° above normal middle and west and normal in east. Thundershowers throughout 15th and 16th, but amounts were light.

Short soil moisture supplies over 50% of State. Fieldwork: 5.0 days suitable. Cotton setting bolls 88%, 1974 77%, average 86%. Boll weevil infestation worst in years. Soybeans good to excellent; blooming 79%, 1974 66%, average 79%; setting pods 38%, 1974 21%, average 38%. Corn 42% dented, 33% dough stage, 19% silking, ahead of 1974, behind average. Early corn hurt badly. Late corn mostly good. Tobacco harvest starting, uneven growth will slow harvest.

TEXAS: Scattered shower activity most areas. Totals heaviest northwest. Several locations Panhandle, excess 2.00 in. Temperatures 4° below normal High Plains, Trans-Pecos, near normal elsewhere.

Corn harvest lagging behind 1974's schedule while harvest sorghum, peanuts, rice on schedule. Sorghum yields disappointing Coastal Bend, south central. Harvest sunflowers complete southern areas. Cotton: Harvest delayed Coastal Bend, Lower Rio Grande wet weather, resumed end of week. Blacklands, south central, rapidly approaching maturity, harvest under way soon. Heavy insect damage noted Blacklands to High Plains; control measures necessary most localities. Sorghum harvest rapidly nearing completion southern areas. Blacklands, east harvest making excellent progress. Yields many localities lower than expected. High, Low Plains insect problems unusually heavy, but crop making satisfactory progress. Major crops percent harvested: Cotton 4, 1974 6, average 5; corn 12, 1974 28, average 21; sorghum 43, 1974 46, average 43; peanuts 5, 1974 3, average 9; rice 53, 1974 63, average 56. High Plains: Potatoes, onions still harvested. Carrots, tomatoes, peppers, cabbage good condition. Cucumber yields good. Trans-Pecos: Cantaloup, onion harvest continues. North: Okra, tomato, cantaloup, watermelon, pea, cucumber harvests continue. Wet weather caused insects, disease. East: Harvest of peas, watermelons, tomatoes, cucumbers continues. Sweetpotatoes requiring irrigation. San Antonio-Winter Garden: Carrot, cabbage planting, some fields up, doing well. Some areas heavy grub infestation. Planting fall cucumbers begun. Lower Rio Grande Valley: Peppers, tomatoes planted prior wet weather doing well. Peach harvest complete except few late varieties. Yellow aphids, web worms in pecans around Rolling Plains. Citrus benefited recent rainfall.

Livestock weathered summer months excellent condition. Dry weather causing pastures turn brown grazing still abundant. Ranchers culling herds to save grazing for fall. Hornflies, ticks, mosquitoes, screwworms continue cause problems. Fall sheep, goat shearing steady progress.

UTAH: Scattered shower and thunderstorm activity midweek. Accumulated amounts of moisture generally light to moderate. Average temperatures generally near normal, ranging from 3° below normal to 6° above.

Winter wheat 50%, spring wheat 18%, barley 25%;

and oats 14% harvested. Second crop alfalfa hay 65% harvested, meadow hay 80%. Late spring planted crops good condition, but need a late frost to mature. Livestock in good condition. Range feed plentiful but dry. Fire warnings posted.

VIRGINIA: Hot, humid showers, thunderstorms with rain averaging 0.60 in. Temperature averaged normal. Extremes: 95 and 52°.

Fieldwork: 5.2 days suitable. Topsoil moisture: 58% adequate, 40% short, 2% surplus, Corn silage harvest increasing. Field crops in good to excellent condition. Soybean insect scouting programs organized, some spraying necessary. Tobacco harvest progress: Flue-cured 27%, 1974 24%. Fire-cured 6%, 1974 S%. Burley, sun-cured less than 3% harvested. Peanuts received chemicals for disease, insect, weed controls. Hay quality good. pasture, hay condition still gnod to excellent. Grazing supplemented with hay still needed in southwest. Cabbage harvest ❑ tarted. Potato, tomato harvest continues.

WASHINGTON: West: Temperatures near normal. Below normal precipitation.

Raspberry picking almost complete. Blueberry, blackberry harvest continued. Cucumber, broccoli, bush bean and vegetable harvest progressing. cauliflower harvest under way. Haying continued. East: Temperatures near normal. No precipitation.

Peach harvest continued. Third cutting alfalfa hay begun. Potato, sweet corn, tomato and melon harvests continuing. Wheat harvest continued full swing. Lentil, dry psa harvest progressing. Grass seed harvest complete, yields below normal.

WEST VIRGINIA: Temperatures above normal. Precipitation above normal with most in northwest and north central.

Favorable workdays 3,8. Soil moisture 31% short, 55% adequate and 14% surplus. Main activities: Haying, clipping pastures and cutting weeds and brush. Second cutting of hay 44% complete. Oats 85% and wheat 95% harveeted. Corn in fair to good condition with 18% pre-silked, 44% silked and 3S% dough stage. Much needed rain helped pastures and hay. Livestock generally in good condition.

WYOMING: Another very dry, cool week. Temperatures all areas below seasonal norm. Precipitation very spotty, mostly below normal.

Small grain harvest continued. Percent harvested: Winter wheat 88%, barley 41%, spring wheat 34%, oats 21%. Second cutting alfalfa 42% cut, other hay 70%. Row crop prospecte mostly good. Corn 81% tasseled, 57% silked. Dry beans 97% in bloom, 66% setting pods, cutting expected to begin about September 1st. Potatoes 93% in bloom, Soil moisture supplies short several areas. Major activities: Combining, haying, irrigating, care of livestock.

WISCONSIN: Warm temperatures prevailed on 11th and 12th, also partly cloudy skies. Some showers and thunderstorms on 11th, more widespread across north on 12th. Cooler on 13th through 17th. Highs 70’s and low 60’s. Scattered rain 15th and 16th generally light.

Oat harvest made rapid progress, SO% combined, 1974 50S, normal 65%. Many farmers finished combining, now baling straw. Corn crop 35% dough stage, 1974 20%, normal 25%. Still under severe moisture stress on light soils. Early corn on heavier soils ❑uch ahead of 1974. Weather favorable for development of European corn borer and rootworms. Second crop hay 70S harvested, 1974 65%, normal 60%. Soybeans need rain for pod set. Pastures have little feed value left. Sweetcorn yields lowered by lack of rain. Ear size and shape deteriorating. Snap beans improved by showers. Commercial cherry harvest near completion. Tobacco being topped. Late planted tobacco needs rain. Soil ❑oisture 93% short, 7% adequate,

WORLD AGRICULTURE WEATHER SUMMARY

HIGHLIGHTS: Drought and record high temperatures in July and early August spread throughout most of western Europe and crops deteriorated. Generous rains boosted crop prospects in much of European USSR, but a large part of the New Lands received little rain and crops continued to decline. In northern parts of European USSR and west Siberia cool weather and some frost in August threatened crops and delayed growth. Increased shower activity in mid-August tended to ease drought in both East and West Europe and in the USSR.

Summer monsoons in Asia are performing well but causing some flooding. Late July and early August rains brightened the production outlook in Canada's Maritime and Prairie Provinces.

WEATHER: Record heat accompanied by drought tormented crops in western Europe, where, except for brief periods of normal conditions, this summer's weather has been more like that in the Mediterranean region than in the North Sea and Baltic areas. Sweden even reported temperatures in the 100. Temperatures moderated in mid-August, however, and rainfall increased.

Eastern Europe experienced more moderate weather--a favorable turn from earlier floods in the Danube Basin and drought in parts of the USSR. Drought persisted, however, in the USSR dry southern Urals and Turgay Plateau of Kazakhstan. Some crops in the southern and eastern Ukraine aren't expected to mature for grain or oilseeds and are being grazed or cut for silage.

In North America rains in late July and early August relieved hot, dry conditions for crops in Canada Maritime and Prairie Provinces. Mexico picked up valuable rains, especially in the previously dry northeast. Scattered rains also eased the prolonged drought in the Caribbean and Central America, although dry spots remain, especially in Honduras, Nicaragua, and Guatemala.

Rain was widespread in Japan the first week of August after several weeks of dry weather, and Typhoon Phyllis added still more at midmonth. North and northeast China and Inner Mongolia got heavy rains in late July and early August at the expense of flooding. Some flooding also occurred in South China. Monsoon rains continued to aid summer crops in Pakistan, India, Bangladesh, and most southeast Asian countries.

Africa's "summer wet" countries received adequate rain for the most part, especially West Africa. Nouakchott in Mauritania had its first substantial rain in 5 years.

July was relatively dry in Argentina and Brazil except for torrential rains in northeast Brazil, where floods damaged crops. Substantial rains fell in mid-August in southern Brazil, Uruguay, and northern Argentina. Central and southern Chile also received beneficial rains. Precipitation was good in coastal areas of Australia but sparce in much of the inland wheat-producing areas of the southeast.

GRAIN: Early seeded-early maturing grains in western Europe weathered the dry, hot summer without severe losses. On the other hand, this unusual weather reduced production prospects for corn and late seeded small grains. In the USSR good rains since late July west of the Volga were too late to save some corn and small grains in the southeastern Ukraine and Volga regions. But rains helped spring wheat in northern and eastern Kazakhstan and west Siberia. Elsewhere in Eastern Europe midsummer weather was generally favorable.

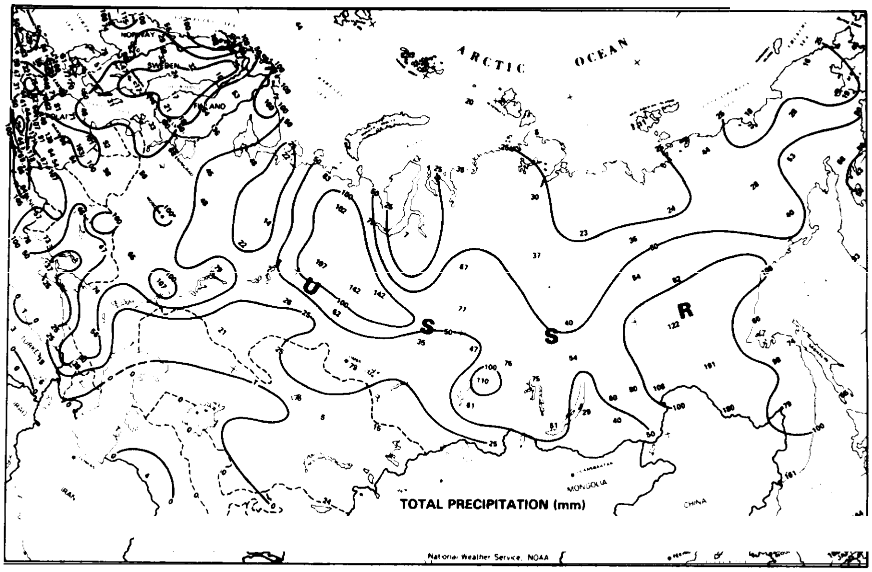
Rainfall improved in much of Central America but dry spots remain and corn and pastures are erratic in Honduras, Guatemala, and Nicaragua. In Canada, the Prairie Provinces continued to receive moisture at the right times and small grain prospects there are good. Moisture conditions are also good for corn and rice in Asia with some monsoon flooding as usual. From June 1 through August 6, areas that produce 84 percent of India's summer cereal grains received normal or above normal precipitation compared to 43 percent in 1974. Flooding in China, however, could be more severe.

Winter wheat is doing well in western and parts of eastern Australia, but infrequent rains caused problems for southern parts of the eastern belt. Except for some freeze losses Paraná winter wheat in Brazil has had mostly favorable weather. Good weather also favored winter wheat in Uruguay and Argentina, but in these areas more wheat is dormant than usual. Brazil lost some corn and rice in the northeast, where up to 20 inches of rain fell in a few days in early July.

Conditions are generally favorable for seeding winter grains in the USSR.

OILSEEDS: July-August rains gave sunflowers a big boost in the USSR, but some acreage was still lost. Drought hurt oilseed crops in much of Western Europe. In Nigeria extensive replanting of peanuts followed insect damage; rainfall was generous but good yields will depend on rains continuing well into October and that would be unusual. Oilseeds are generally doing nicely in North America and India but could have been hurt by some flooding in China.

OTHER: In Brazil the July 17-19 freeze damaged sugarcane, pastures, vegetables, bananas, and coffee in the south, while floods damaged tobacco, manioc, rice, corn, beans, and cotton in the northeast. Heavy summer rains increased incidence of coffee berry disease in Kenya. Prolonged drought in much of western Europe caused milk production, pastures, sugarbeets, fruits and vegetables to deteriorate, however, rainfall picked up in mid-August. Potato and onion yields are expected to decline. Summer rains in Cuba improved sugarcane and other crop prospects. A USSR weather and crop report indicated good cotton growing conditions in central Asia. Thunderstorms in Spain Leon Province on August 3 caused severe crop damage that could include the loss of more than half of Spain hop crop.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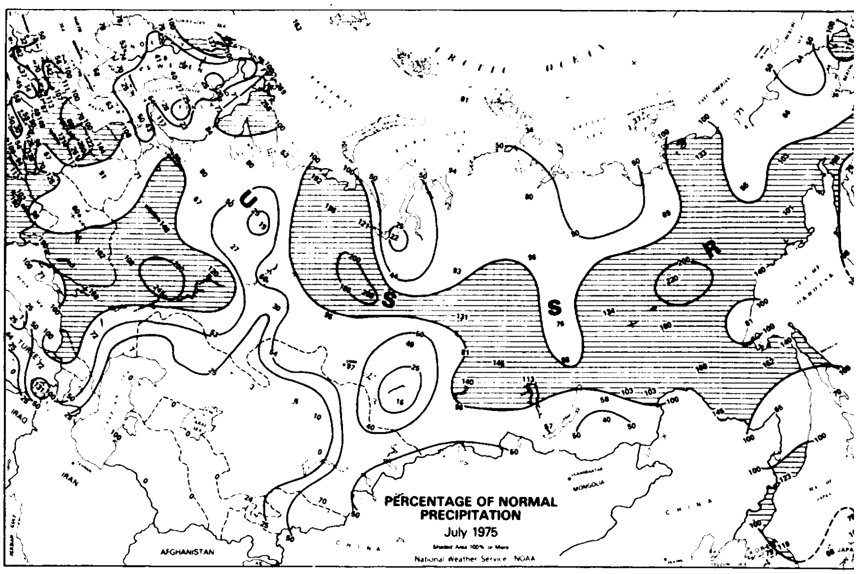
National Weather Service, NOAA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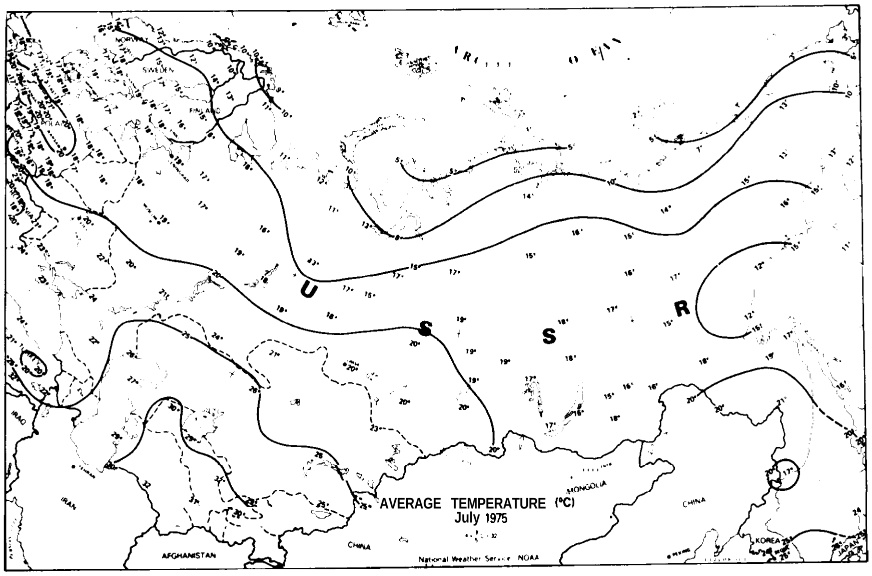
July 1975
National Weather Service, NOAA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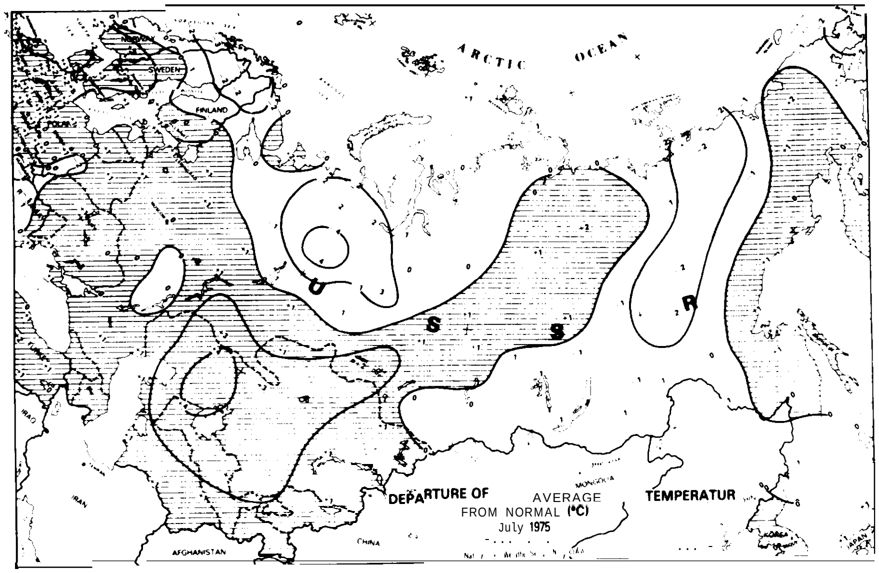
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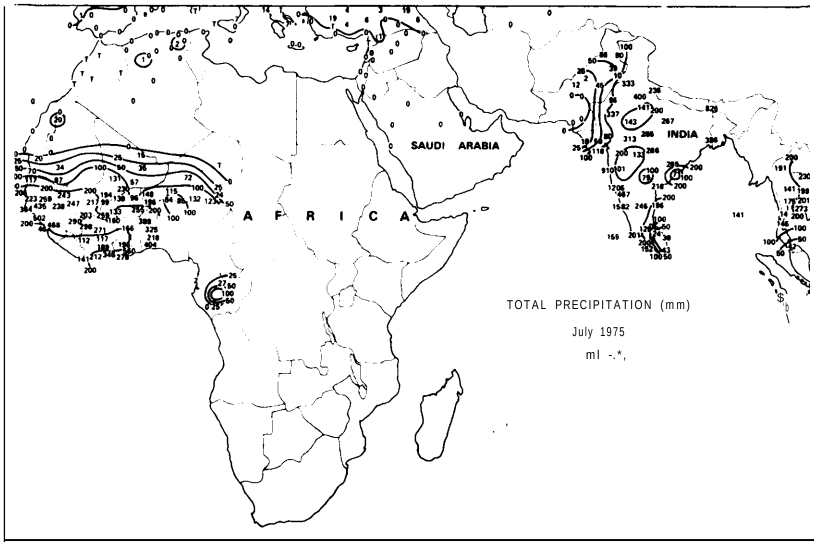

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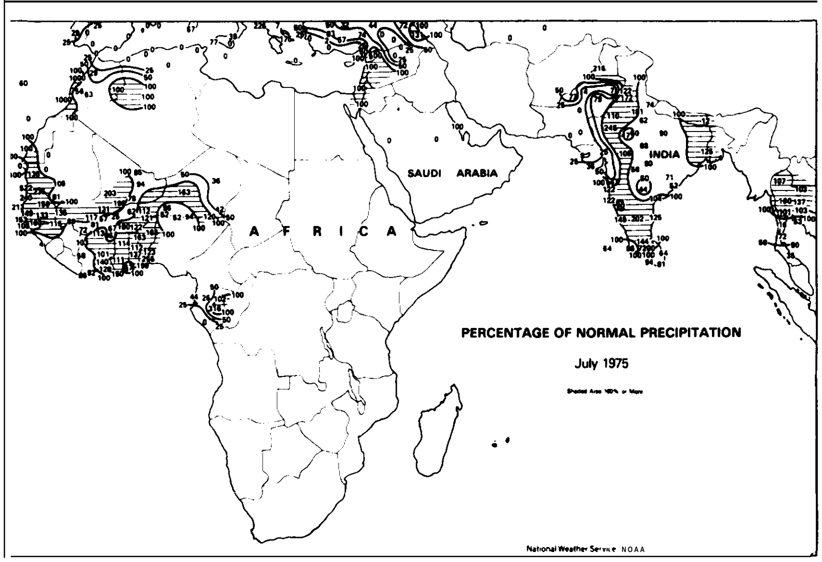

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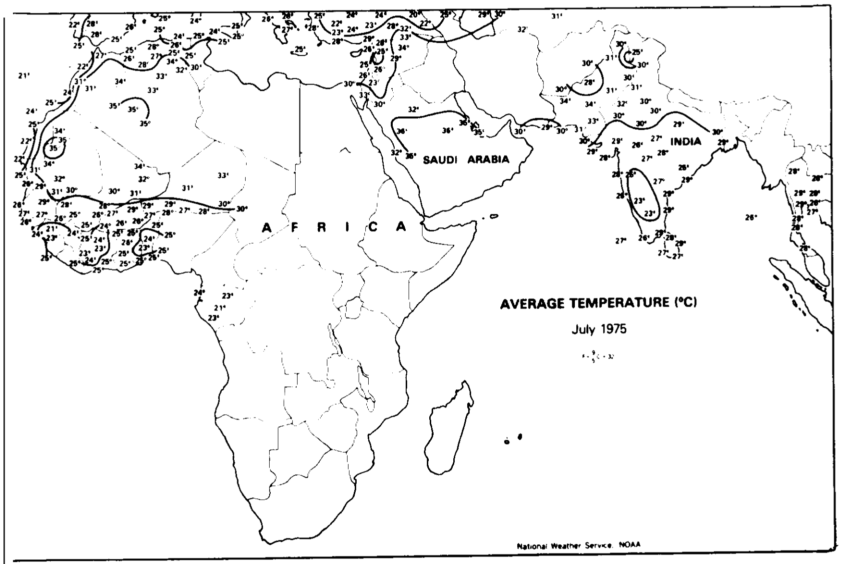
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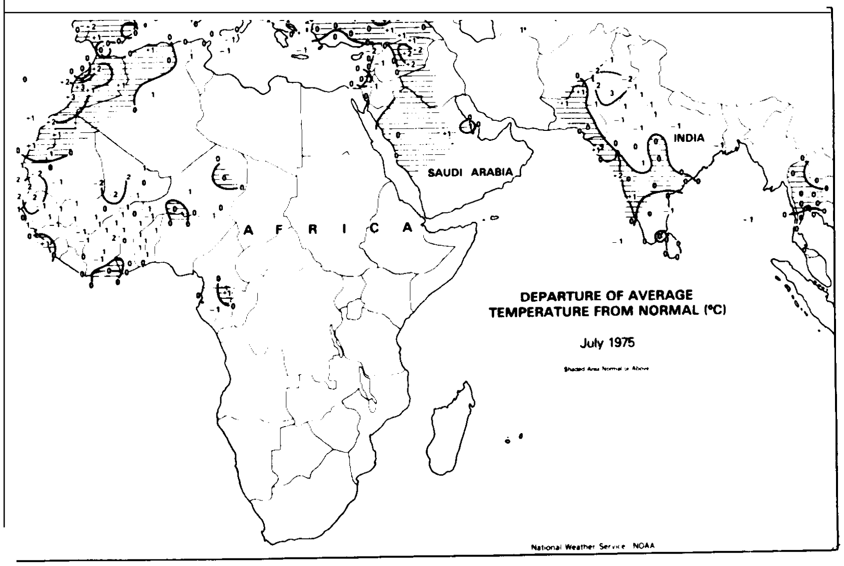
AVERAGE TEMPERATURE (°C)
July 1975
National Weather Service NOAA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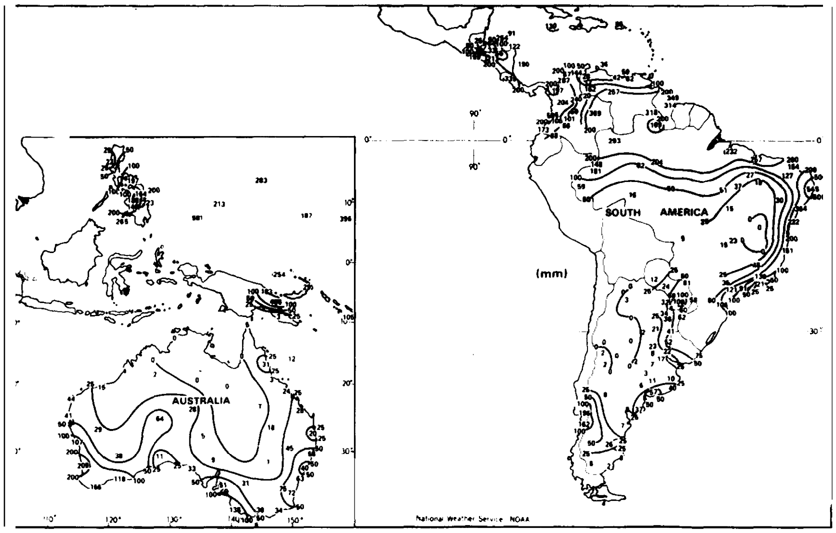
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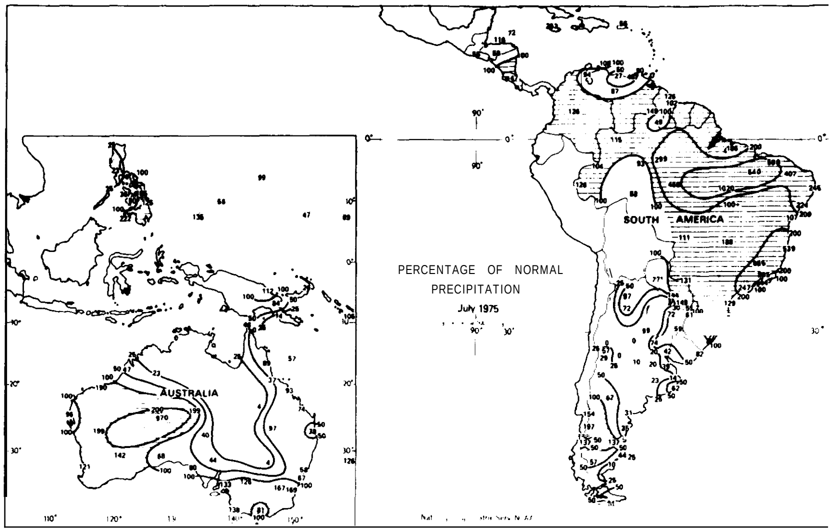
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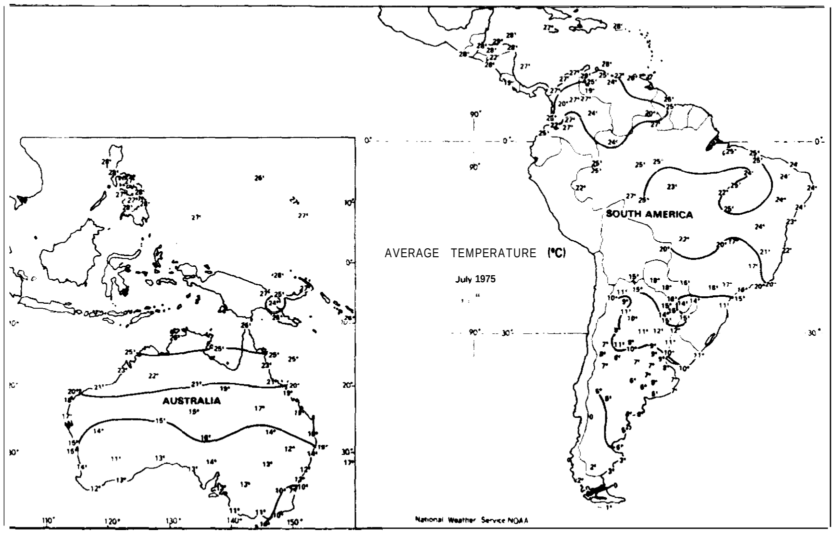
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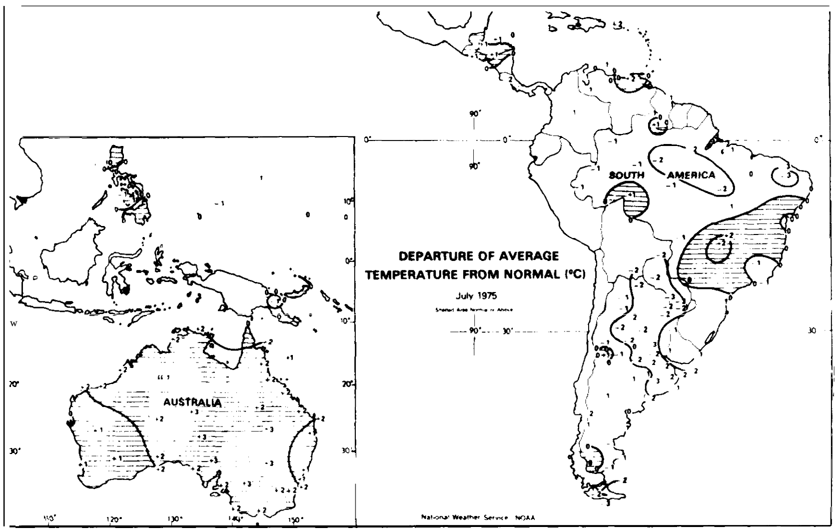
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TEMPERATURE FROM NORMAL (°C)
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SOUTH AMERICA
AUSTRALIA
National Weather Service NOAA

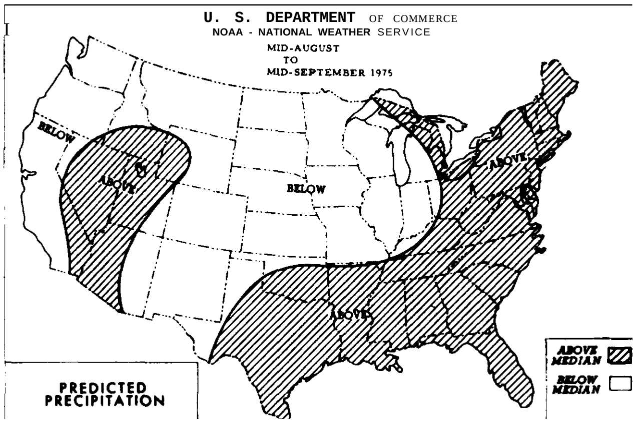
AVERAGE MONTHLY WEATHER OUTLOOK

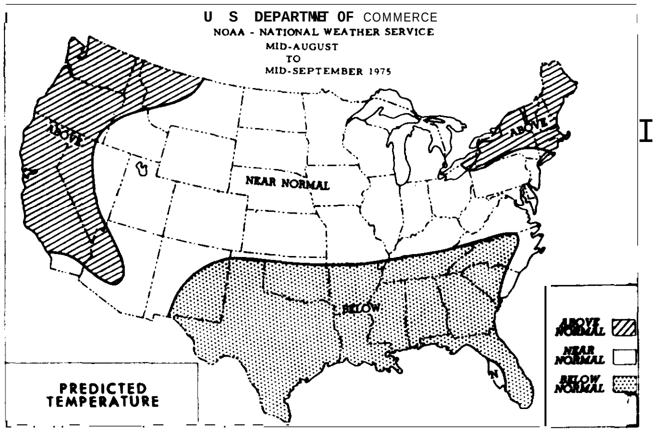
AGRICULTURAL IMPLICATIONS Continued above nor- mal precipitation and be low normal temperatures in the Southeast come at a time when cot ton needs lots 0 f warm, sunny weather to produce a good quality crop. Insect control is more difficult in wet weather.

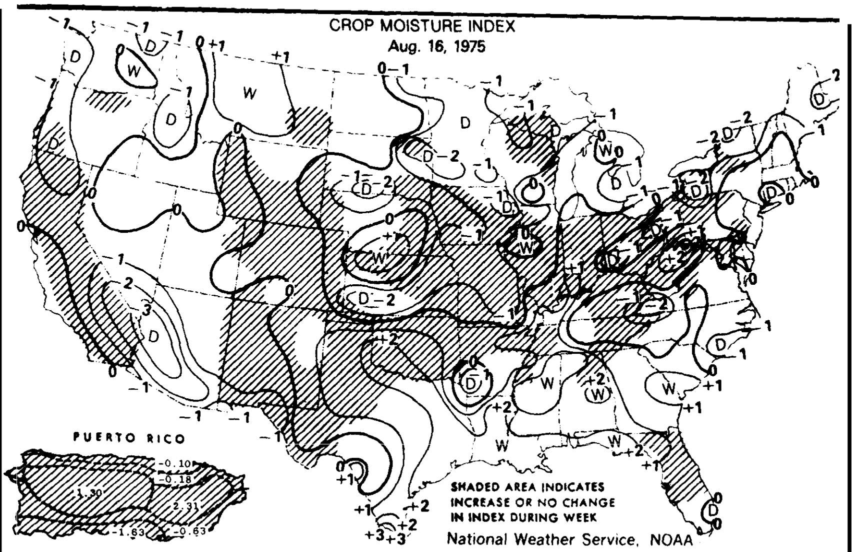
In corn and soybean areas, below normal precip - itation will deter formation of dry matter in crops and result in lighter weights i n areas where soil moisture is al ready short I.n areas where soil moisture is ample and corn and beans are ahead o f normal , crops will likely survive a dry period better, especially with the predicted nor- ma 1 temperatures.

1 n New England above normal precipitation and temperatures will he 1P Maine pot a toes

Pastures In the Great Plains will deteriorate further with the predicted below normal rainfall.







The map above gives a general picture of how wet or y the nat ion was last week The lines show the crop-isture situation according to. n index computed from lues of temperature and precipitation by ● reas . Previous ekly computations of soil moisture account for the effect prior weather.

Shaded areas are those where precipitation increased e index last week or where soils did not dry. Unshaded areas dried last week. The centers of wet or dry areas ● re marked: W for wet; D for dry. Use the legend to interpret.

Local variations caused by isolated rain or by soil differences are not shorn. Any interpretation must consider the type of Agriculture and the stage of crop development .

ISHADED AREAS. INDEX DECREASED

IOVE	3,0 SOME DRYING BUT STILL Excessively WET
!.0 to	3.0 MORE DRT WEATHER NEEDED, WORK DELAYED
[.0 to	2.0 FAVORABLE, EXCEPT STILL TOO WET IN SPOTS
0 to	1.0 FAVORABLE FOR NORMAL GROWTH AND FIELDWORK
0 to	'1 .0 TOPSOIL WI STURE SHORT, GERUINATION SLOW
[.0 to	-2.0 ,4 BNORMALLY DRY, PROSPECTS DETERIORATING
!.0 to	'3.0 TOO DRY, YIELD PROSPECTS REDUCED
1.0 to	'4.0 POTENTIAL YIELDS SEVERELY CUT BY DROUGHT
:LOW	'4.0 EXTREMELY DRY , MOST CROPS RUINED

SHADED AREA: INDEX INCREASED OR DID NOT CHANGE

AROVE	3,0 EXCESSIVELY SST SOME FIELDS FLOODED
2.0 to	3 .0 TOO NET, SOME STANDING WATER
1.0 to	2.0 PROSPECTS ABOVE NORMAL, SOME FIELDS TOO WET
0 to	1,0 MOISTURE ADEQUATE FOR PRESENT NEEDS
0 to	'1.0 PROSPECTS IMPROVED BUT RAIN STILL NEEDED
-1.0 to	-2.0 SOME IMPROVEMENT BUT STILL TOO OSY
-2.0 to	-3.0 DROUGHT EASED BUT STILL SERIOUS
-3.0 to	-4.0 DROUGHT CONTINUES RAIN URGENTLY NEEDED
BELOW	'4. o NOT ENOUGH RAIN STILL EXTREMELY DST

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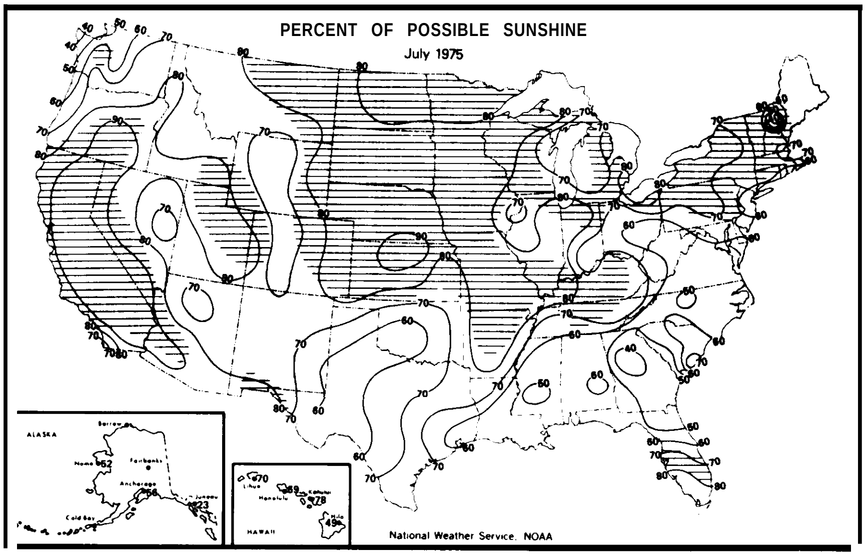

[The following paper was requested from AID by OTA:]

AGRICULTURAL INFORMATION SYSTEM OF AID

The Agency for International Development (AID) does not operate an Agricultural Information System in the context which concerns the Office of Technology Assessment (OTA) and the Congress. As we understand this latter interest, it relates primarily to information systems which provide data and assessments to the Executive Branch of the U.S. Government and to the Congress on prospective and actual harvest yields and food supply availabilities in foreign countries, particularly for those in which the food production level can have a significant impact on the worldwide demand for or the supply of a particular crop or crops.

Food and nutrition problems in AID-assisted developing countries have the highest priority in AID program policy, reflecting both our judgment of developmental priorities and the predominant emphasis accorded this program area in the Foreign Assistance Act. AID accordingly gives major attention to the status of agriculture and to general food and nutrition matters in the countries in which it has programs, making available to its own field personnel and to host country authorities and institutions a broad array of advice and guidance on food production, storage and distribution, AID could be said to operate agricultural information systems of two kinds. We study and analyze the food and nutrition status in cooperating countries, in the process of making programming decisions on the amount and nature of assistance that is desirable and possible for the agricultural sector. This involves the preparation of sector assessments and analyses which, along with comparable studies by the I.B.R.D., probably constitute the most exhaustive and reliable sources of information on agriculture in developing countries. Secondly, we develop and compile relevant technological data for use by ourselves and our contractors/grantees in providing advice and assistance for agricultural improvement in LDC's.

However, AID does not make any independent effort to accumulate information on anticipated or actual crop yields in cooperating countries. We use data made available by host country governments, international organizations, and the U.S. Department of Agriculture as the basis for our judgments as to the relative importance of assistance to individual LDC's or to the developing countries generally on the production, storage and marketing of a specific crop or of food products generally. We are concerned with production information as it affects planning for assistance in the agricultural sector. This requires that in individual countries we have some judgment as to the adequacy of national food production data and that we concern ourselves with the availability to host government of timely and accurate food production and other statistics as they may be required for policy formulation and program management.

In this regard, we have been engaged in extensive technical cooperation with the Ministry of Agriculture in almost every country with which we have had a bilateral assistance program. AID agriculture program planners and project designers in the natural course of their interaction with host country agricultural authorities have identified crop reporting, agriculture census methods, and other improved agricultural statistics as areas for technical assistance activity when they seemed important to achievement of overall agricultural program goals and objectives. A substantial but undeterminable number of LDC personnel have come to the U.S. during the last twenty years from many of the cooperating countries for orientation on the crop reporting function or for training in the techniques used in operating a crop reporting system or an agricultural census.[1]

Further, the training in agricultural sciences provided to thousands of LDC personnel who have attended U.S. universities under AID agricultural projects has in many cases included some coverage of crop reporting systems and techniques.

AID has not given special policy emphasis to technical assistance for the establishment or strengthening of crop reporting systems. The judgment as to the priority of this specific aspect of agricultural development has been left to the assessment of those engaged in the analysis of agriculture sector situations and the design of programs and projects. The significance of adequate crop reporting systems in other countries for policy development and program formu-

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1 In fiscal year 1975, approximately 130 AID-financed trainees from LDCs were assigned for varying periods to the Department of Agriculture% Statistical Reporting Service for study of crop reporting systems.

lation by the U.S. Government, the governments of other food exporting countries, and international organizations, as discussed in the OTA documents, has not to date influenced AID's policy or programming. While the latter must be responsive to domestic considerations in many ways, the fundamental determinant of program content has been and remains the host country situation and its development objectives and requirements. We could increase the policy priority of crop reporting in our technical assistance programs, but the actual planning and implementation of training and technical advice for the improvement of LDC crop reporting systems would depend in each country upon the interest of the local government.

AID personnel have been involved peripherally in and have made contributions to the international crop reporting system of the Department of Agriculture, which depends upon reports received from Agricultural Attaches in U.S. Embassies abroad. Agricultural Attaches often have used their contacts with AID direct-hire and contract agricultural technicians, frequently dispersed over the host country, to supplement and reinforce their own observations as to progress with planting, the effect of rainfall and other climatic conditions on germination and growth of crops, and estimates of probable yields as harvest approaches. This has not been a systematically organized cooperation but has been found both natural and convenient for Agricultural Attaches in many instances, depending upon the desire of the particular individual to make use in this way of personnel in the country under the AID program.

AID further has contributed in recent years to the possible improvement of international crop reporting quality and timeliness by its technical assistance to cooperating countries in the utilization of data made available by U.S. remote sensing satellites. Many LDC's have requested ERTS data for agriculture-related purposes. These in some cases have significance for more accurate and more timely crop reporting, providing, for example, improved knowledge of acreage planted in the aggregate and to specific crops, early knowledge of disease outbreaks, and indications of crop maturation and yield. AID has assisted developing countries to prepare for exploitation of ERTS data, providing technical training and consulting advice to help integrate the information from this source into the countries' own systems for assembling information to support agricultural planning and program management.

In summary, AID: (a) has made many technical assistance efforts over the years to improve LDC crop reporting information systems; (b) stands ready to continue such assistance; and (c) could increase the attention given to this aspect of agricultural development assistance where warranted by country analysis of priorities necessary to raise agricultural production. AID does assemble substantial amounts of information on LDC agricultural situations and conducts an extensive system to collect and disseminate technological information for assistance to cooperating countries.

The hearing is adjourned.

[Whereupon, at 4:45 p.m., the hearing was adjourned, subject to call of the Chair.]

O