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**PREPARING FOR DROUGHT  
IN THE NEW MILLENNIUM**

**DRAFT REPORT OF THE  
NATIONAL DROUGHT POLICY COMMISSION**

**MARCH 8, 2000**

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## Foreward

In July 1998, the 105th Congress enacted Public Law 105—199, the National Drought Policy Act. This law established “an advisory commission to provide advice and recommendations on the creation of an integrated, coordinated Federal policy designed to prepare for and respond to serious drought emergencies.” The law directed the Commission to “conduct a thorough study and submit a report on national drought policy.”

Commission members were chosen according to provisions in the Act, which required representation of federal and nonfederal government entities and the private sector. The Act directed the current Secretary of the U.S. Department of Agriculture, Dan Glickman, to chair the Commission. Members of the Commission selected Ronald R. Morriss of the Santa Cruz County Board of Supervisors (Arizona) as Vice Chair.

This document constitutes the report of the National Drought Policy Commission. The report presents the basis for national drought policy and calls for commitment and resolve in providing sufficient resources to achieve the policy goals.

None of our recommendations should be construed as interfering in any way with states’ water rights, as specifically directed by the National Drought Policy Act, and all should be considered in light of the need to protect the environment—which was also required by the Act.

## Contents

|  |         |
|--|---------|
| Summary of Recommendations for Proactive National Drought Policy | Page 4  |
| From Relief to Readiness   | Page 6  |
| Opportunity for Action   | Page 8  |
| Consequences of Drought  | Page 9  |
| Defining Drought   | Page 10 |
| Stored Water and Natural Water Droughts                          | Page 11 |
| Findings   | Page 13 |
| Program Assessments  | Page 14 |
| States   | Page 14 |
| Regional Entities  | Page 15 |
| Localities   | Page 15 |
| Tribes   | Page 17 |
| Federal Government   | Page 18 |
| Planning   | Page 18 |
| Mitigation   | Page 20 |
| Monitoring/prediction and Research                               | Page 21 |
| Risk Management  | Page 23 |
| Response   | Page 25 |
| Need to Coordinate Drought-related Programs                      | Page 26 |
| Need for Public Education  | Page 27 |
| Need to Address Environmental Concerns                           | Page 27 |
| Need to Address Drought-related Wildfires                        | Page 29 |
| Need for Training and Technical Assistance                       | Page 30 |
| Need to Address International Drought-related Issues             | Page 30 |
| Conclusions  | Page 32 |
| Recommendations  | Page 34 |

## Summary of Recommendations for Proactive National Drought Policy

Drought will occur at some time somewhere in almost any given year in the United States. It can and does extend over long periods and large areas, and it can and does bring hardship.

Each time drought occurs, many of the same issues are raised. Principally, how much damage was inflicted, on whom, and where? Who is going to pay for it? How can we prevent or at least reduce damages and their costs in the future?

In 1998, Congress passed the National Drought Policy Act. The Act stated that this nation would benefit from national drought policy based on preparedness and mitigation to reduce the need for emergency relief. The Act acknowledged that this country has no consistent, comprehensive policy driving the federal role to help reduce the impacts of drought. And the Act created the National Drought Policy Commission to advise Congress on how best to:

- Integrate federal drought laws and programs with ongoing state, local, and tribal programs into a comprehensive national policy to mitigate the impacts of and respond to drought.
- Improve public awareness of the need for drought mitigation.
- Achieve a coordinated approach to drought mitigation and response by governments and nongovernmental entities, including academic, private, and nonprofit interests.

The basic premise of the Commission's recommendations is straightforward: **We can reduce this nation's vulnerability to the impacts of drought, and thus reduce the need for emergency relief, by making preparedness the cornerstone of national drought policy.** Investments on the front end in preparedness will save money over the long run.

This premise and our specific recommendations are based on findings from our assessments of state, regional, local, tribal, and federal drought programs and laws, on information presented by the public at our hearings across the country and in written comments submitted independently, and on our own experience.

The National Drought Policy Act directed the Commission to recommend whether all federal drought preparation and response programs should be consolidated under one existing federal agency and, if so, to identify that agency. We believe that such consolidation would be impractical and ineffective. Drought affects a wide array of constituents, among them farmers, ranchers, non-farm businesses, tribes, water districts, municipalities, and industry. The federal expertise required to address the needs of these constituents and the impacts of drought on the environment resides in many agencies. The federal agencies currently involved in drought programs report to multiple congressional authorizing and appropriating committees, making it difficult to restructure these authorities appropriately in a timely manner.

In arriving at its recommendations, the Commission considered the option of consolidation and three others, and concluded that the best alternative would be to create a National Drought Council. The primary function of the Council is to ensure that the goals of national drought policy are achieved. The goals are:

1. Incorporate planning, implementation of plans and mitigation measures, resource stewardship, environmental considerations, and public education as the key elements of effective national drought policy.
2. Forge closer ties among scientists and managers so that scientists understand which monitoring, research, data collection, modeling, and other scientific efforts are needed to reduce drought impacts

and improve public understanding of those impacts.

3. Develop and advocate comprehensive risk-management strategies into drought preparedness.
4. Maintain a safety net of emergency relief that rewards good stewardship of natural resources and self help.
5. Coordinate drought programs and response.

## **FROM RELIEF TO READINESS**

For years, farmers and ranchers, Native tribes, scientists, economists, small business owners, conservationists and wildlife managers, small and large municipalities, counties, states, regional entities, and the federal government have grappled with the far-reaching consequences of drought. Numerous papers, reports, and books have recorded and analyzed the impacts of drought. They have pointed out over and over again that drought planning and mitigation programs may well reduce the need for huge federal emergency relief expenditures in drought-stricken regions—usually to assist farmers and ranchers and rebuild local economies—and also reduce conflicts over competition for water during drought.

Many states and local governments include drought in their comprehensive water management, land-use, and long-term planning strategies or are devising separate drought plans. These government entities know best about local resources and local priorities, and they know how to communicate with their constituencies and stimulate people to action. Some farmers, ranchers, and other businesses also incorporate drought concerns into their risk-management assessments. Private entrepreneurs and nonprofit groups with an interest in water management and environmental issues work with governments to carry out drought education projects and water conservation initiatives that rely on the cooperation of the general public. In response to individual challenges over the years, Congress has enacted laws to create federal programs aimed at lessening the impacts of drought, and special congressional appropriations of federal taxpayer dollars underwrite much of drought relief.

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Researchers have found it difficult to define drought impacts and separate them from the effects of general economic trends. For example, the decision to build a hydropower plant is based on the capacity provided during the most severe droughts. Yet some researchers report the difference between hydropower production in a drought and in a “normal” year as a loss. And droughts can last for years. This makes it difficult to determine if a loss in, say, landscaping investments is because of drought or because of declining disposable income from an economic downturn.

But the most conservative estimates of drought impacts are still large. The Commission found several studies of the federal government’s response to the major post-World War II droughts and updated those findings of federal drought expenditures to current dollars. The National Science Foundation’s Climate Dynamics Program funded “Government Response to Drought in the United States: Lessons from the Mid-1970’s” (June 1984) that indicated the federal government spent \$3.3 billion responding to the 1953-1956 drought. Various studies indicate that federal drought response cost at least \$6.5 billion during the 1977-1978 drought and about \$6 billion during the 1988-1989 drought. The last figure does not include crop insurance payments. Thus, extraordinary federal expenses alone over the 1952-1988 period averaged approximately half a billion dollars per year.

Clearly, there were also uninsured municipal and agricultural losses. “Impacts and Implications of the 1987-1989 Drought,” prepared for the Natural Hazards Research and Applications Information Center at the University of Colorado, documents a reduction in crop production of nearly \$20 billion and an increase in food prices of over \$12 billion because of the 1988 drought. The report also noted that low flows on the Mississippi in 1988 caused barge shipping prices to double and triple, leading to an estimated \$1 billion in increased transportation costs. At the Commission’s hearing in Austin, Texas, the Texas Agriculture Commissioner stated that the 1996 and 1998 droughts in her state caused a loss of \$4 billion in direct income, with the total impact to the state’s economy close to \$11 billion.

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From a national perspective, these well-intentioned efforts have produced a patchy approach to reduce the impacts of drought. And despite the major role that the federal government plays in responding to drought events, no single federal agency is in a lead or coordinating position regarding drought. State, local, and tribal governments must deal individually and separately with each federal agency involved in drought assistance. Crisis management—rather than planning, mitigation measures, and risk management—often characterizes the federal response to drought emergencies.

The challenge in formulating national drought policy is to move away from the need for emergency relief. Investments in preparedness actions such as planning and implementation of plans and mitigation measures will reduce risks. Recognition of risks that exist after preparedness measures are in place and development of risk-management strategies will, in turn, reduce the need for emergency relief.

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## OPPORTUNITY FOR ACTION

In the National Drought Policy Act of 1998, Congress presented this country with an unparalleled opportunity. This law explicitly recognized the need to prepare for and lessen the severe impacts of drought on the American people and the environment. It created the National Drought Policy Commission to advise Congress on formulation of national drought policy based on preparedness and mitigation, thereby reducing the need for huge relief expenditures that currently comprise the cornerstone of federal response to drought. The Act also directed the Commission to present a strategy that shifts from ad hoc federal action toward a “systematic process similar to those for other natural disasters” and to integrate federal programs with “ongoing state, local, and tribal programs.”

Accordingly, the Commission’s vision is of a well-informed, involved U.S. citizenry and its governments prepared for and capable of lessening the impacts of drought—consistently and timely. Drought policy should improve national security and foster economic prosperity, environmental quality, and social well being. It should also benefit future generations as well as our own.

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The law that created the National Drought Policy Commission called for national drought policy based on preparedness and mitigation, thereby reducing the need for huge relief expenditures that are the cornerstone of federal response to drought events.

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The National Drought Policy Act assigned eight tasks to the Commission, listed in the box on this page. The next pages describe the consequences of drought, discuss drought definitions, and present our findings, followed by conclusions and recommendations for action.

### **BOX—Charge to the National Drought Policy Commission**

- Determine, in consultation with the National Drought Mitigation Center in Lincoln, Nebraska, and other appropriate entities, what needs exist on the federal, state, local, and tribal levels to prepare for and respond to drought emergencies.
- Review all existing federal laws and programs relating to drought.
- Review pertinent state, local, and tribal laws and programs relating to drought.
- Determine what differences exist between the needs of those affected by drought and federal laws and programs designed to mitigate the impacts of and respond to drought.
- Collaborate with the Western Drought Coordination Council and other appropriate entities to consider regional drought initiatives and the application of such initiatives at the national level.
- Recommend how federal drought laws and programs can be better integrated with ongoing state, local, and tribal programs into a comprehensive national policy to mitigate the impacts of and respond to drought emergencies without diminishing the right of states to control water through state law and considering the need to protect the environment.
- Recommend how to improve public awareness of the need for drought mitigation and develop a coordinated approach to drought mitigation and response by governmental and nongovernmental entities, including academic, private, and nonprofit interests.
- Recommend whether all federal drought preparation and response programs should be consolidated under one existing federal agency and, if so, identify such agency. —**END BOX**

## CONSEQUENCES OF DROUGHT

Drought is perhaps the most obstinate and pernicious of the dramatic events that Nature conjures up. It lasts longer and usually extends across larger areas than hurricanes, tornadoes, floods, and earthquakes. At its most severe, drought creates vast, windblown dust bowls—eroding the landscape, damaging terrestrial and aquatic wildlife habitat, contributing to widespread wildfire, costing hundreds of millions of dollars, and dashing innumerable hopes and dreams.

Drought may be the last straw in driving farm and ranch families off their land, “mom and pop” livestock producers out of business, tribal farmers and ranchers to financial despair, or native species to the brink of extinction. It brings hardship to water-dependent recreation enterprises such as commercial fishing, marinas, river outfitters and guides, landscapers, golf courses, and water theme parks. In many small communities, downturns in farming, ranching, and recreation have a rippling effect, causing loss of income for seed and implement retailers, recreation equipment suppliers, and Main Street businesses—from grocery stores to clothing outlets, entertainment operations, restaurants, and banks. This in turn creates revenue shortfalls for local governments.

Drought can have devastating impacts on the lives of migrant agricultural workers and people employed in seasonal, recreation-dependent jobs. And it can lead to tough decisions regarding allocation of water, stringent water-use limitations in large urban areas, and problems in ensuring safe drinking water as well as adequate water supplies for city, county, and rural fire-fighting efforts.

In large managed river basins and water systems such as the Columbia, Missouri, the state and federal California reservoir systems, the Colorado River, the Apalachicola-Chattahoochee-Flint, and others, drought creates or exacerbates conflicts about who should get water. The most common conflicts are between older, established uses such as agriculture and navigation versus newer uses such as recreation and municipal water for growing populations, and between water for direct human use and for ecosystems.

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### Drought Snapshots from 20th Century America

**1930s**—The decade-long Great Plains drought turned 50 million acres into the Dust Bowl across the Plains, caused a huge migration from the southern Plains to California, and revolutionized agriculture policy on the Plains.

**1950-1954**—Drought across the Southwest and southern plains claimed millions of cattle and forced hundreds of ranchers to ship their livestock to other regions of the country.

**1976-1977**—Lack of winter snowfall resulted in extreme drought conditions in the Pacific Northwest and California. This drought was short lived. Nevertheless it placed great stress on water supplies.

**Mid-1980s to mid-1990s**—Prolonged drought lasting up to seven years hit California, the Pacific Northwest, and the Great Basin states. The Midwest and parts of the Southeast experienced drought emergencies in 1988.

**Late 1990s**—Southeastern and mid-Atlantic states experienced a “100-year” drought that extended through parts of the Northeast. The torrential rains that accompanied hurricanes Dennis and Floyd in the late summer of 1999 only exacerbated the impacts of the drought.

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## DEFINING DROUGHT

The definition of what drought is and what drought is not has profound implications for the environment and all segments of society, yet it may be different for each. Many attempts have been made to develop a comprehensive and meaningful definition. A generic definition provides a starting point: “Drought is a persistent and abnormal moisture deficiency having adverse impacts on vegetation, animals, or people.”

This definition has the elements that most of the more detailed definitions have in common:

- Drought is not a short-term but a persisting condition.
- Drought represents a condition that is abnormal, so that dryness during a normal dry season or in an arid climate is not “drought.”
- Drought may be more than a shortage of rain or snow, but can result from combinations of precipitation shortfalls and abnormally high temperatures and low humidity; hence the term “moisture deficiency” rather than rainfall deficiency.
- Drought does not occur until there are adverse impacts, and these impacts can be reflected in various ways such as harm to crops, pastures, or woodlands; harm to livestock or wildlife; impacts on the water supplies upon which people depend; or economic impacts to drought-stricken businesses or communities.

The Commission has found that drought is defined differently in different situations. For example, two months without rainfall during the growing season may result in serious drought conditions for farmers and homeowners in the Eastern half of the country. The same dry period may be normal for those in the West, where water users may be more concerned with reservoir levels, which in turn are dependent on winter snow pack levels.

In addition, the definition of “what is drought” has different functions depending on the goals to be achieved. For the purposes of planning and mitigation, communities, business owners, and individuals need fact-based information that helps define strategies to mitigate potential impacts of drought. To respond to a “real” drought, the declaration that “this is drought” triggers certain actions such as restrictions on the availability of water to users and activation of government response programs. The impact of drought on specific water users, not the definition of drought, triggers the initiation, frequency, and costs of federal, state, regional, and local assistance.

National drought policy must therefore define drought so that it meets the needs of diverse water users and for diverse functions. It must be flexible enough to include a variety of drought situations, but specific enough to distinguish between those situations which are true drought emergencies and those that are normal cyclical conditions.

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Because of the extremely diverse climates, topographies, watersheds, water sources, and water uses within this country, we find it impractical to define specific drought thresholds that could

act as triggers for drought actions for various parts of the country. However, we recognize that a suite of objective triggers similar to those used by the Australian Drought Policy Review Task Force has the advantage of taking much of the politics out of drought-response decisions. As in Australia, these should be both supply-type triggers, reflecting moisture deficiencies caused by acts of nature (lack of rain, excessive temperatures), as well as demand-type triggers reflecting drought impacts.

Examples of current supply-type triggers used to define drought or trigger actions relating to potential drought include: precipitation less than 60% of normal for the season or present water year (used by the National Weather Service Western Region); precipitation less than 85% of normal over the past six months (used by the National Weather Service Eastern Region); the Palmer Drought Index -2.0 or less; and consolidated drought indices at the 20th percentile or less (used by the Drought Monitor). For federal action, more rigid triggers such as 5th percentile drought might be appropriate, reflecting truly unusual circumstances.

Examples of demand (impact) based triggers include water supply less than 60% of normal (used by the National Weather Service Western Region) and various crop loss thresholds used by the U.S. Department of Agriculture.

### **“Stored Water” and “Natural Water” Droughts**

We note that the United States experiences two types of drought. One type occurs when large stores of water in man-made reservoirs, natural lakes, and groundwater aquifers are depleted by very long, unusually low periods of precipitation. This type of drought primarily affects urban areas and agriculture near rivers such as the Missouri and Colorado that have large reservoirs and conveyance systems.

The second type of drought may be called natural water drought. It happens quickly and fairly frequently after just a few weeks or months of below normal rains and has its greatest impacts on farmers and ranchers who do not rely on irrigation and on some rural communities and the environment.

Those who share stored water are rarely affected by less than normal precipitation because the systems are designed to provide water during those times. But the very success of such systems creates a new kind of vulnerability to drought that was revealed in the Northeast during drought in the 1960s, the 1977-78 and 1988-1993 droughts in California, droughts around the country in the late 1980s, and the mid-Atlantic, southeastern, and northeastern drought in 1999. Specific issues vary, but the pattern is common:

- People without enough stored water build reservoirs or tap into existing surface or groundwater storage.
- Reliable water helps support greater populations and more diverse uses of water. Hydropower dams create popular fishing and boating lakes, and valuable lake view property. Reservoir operating policies are supposed to assure minimum flows for fish and wastewater dilution when there would otherwise not be enough water in the stream. Cities and farmers increase their withdrawals as they prosper and grow.
- An unusually long dry period forces reservoir operators to draw down these man-made lakes to support withdrawals for cities and farms, produce hydropower, and keep enough water in navigation channels for barges to float. But homes and businesses around the lake now have views of mud flats. Boat ramps no longer reach the water. Lake fisheries suffer when releases are made for riverine species.
- No one can tell when it will rain enough to reverse this trend, so water deliveries have to be reduced, but to whom first and by how much?
- There may be a conflict between fairness and good economic policy in making water alloca-

tions. The newest water uses may generate more income and tax revenue than the oldest established uses.

People who share stored water would benefit from broader application of new techniques that can help them visualize the impacts of future droughts and work together to design strategic and tactical plans that reduce drought impacts and conflicts. This includes residential and industrial users, hydropower producers, individuals and businesses who use lakes and rivers for recreation, commercial fisheries and navigators, and irrigators. In addition, concern for protection of environmental resources must be considered.

Natural water droughts mostly affect people such as farmers and the owners of water-dependent recreation businesses who rely on direct precipitation or unregulated stream flows. These people are usually the first to feel the effects of drought. Farmers who do not have irrigation systems, for example, take a risk when they plant crops that there will be enough rain throughout the growing season to produce a successful harvest. For the most part, the risk is based on how often there has been enough rain in the past. Long-term predictions of precipitation are still too unreliable to reduce that risk in a meaningful way.

At our hearings across the country, we were told of several gaps among existing programs and the needs of farmers and ranchers who do not rely on irrigation:

- Farmers and ranchers may lack information about local climate and drought conditions and predictions. Many also lack basic soil information; a soil survey remains to be completed for approximately 10% of the country. These deficiencies can limit the ability of producers to make timely decisions on the types of crops to plant or whether to reduce stocking rates on the range.
- Many agriculture producers do not have the knowledge or resources to develop and implement a water conservation/drought plan. Less than 10% of farmers and ranchers are receiving technical assistance to help them develop and implement such plans, and an even smaller number are receiving cost-share assistance for these plans.
- Federal crop insurance covers only the “primary” crops grown and does not extend to other crops or to livestock. We learned that during drought the price of transporting feed after stored supplies are used up is prohibitive in many cases, as is the price for transporting water to livestock ponds gone dry.

We heard too that when drought impacts the incomes of farmers and ranchers and the owners of water-dependent businesses, it also impacts the incomes of nearby local businesses. Such economic impacts may extend further to nearby cities.

## FINDINGS

Our assessments of state, regional, local, tribal, and federal drought-related programs indicate that there is broad-based understanding of the value and benefits of drought preparedness. The assessments also revealed that, overall, federal drought assistance to states, local governments, tribes, and individuals is primarily response oriented, with few federal programs designed to provide drought preparedness assistance. Furthermore, public testimony strongly indicated varying degrees of satisfaction with the federal programs.

Our deliberations have convinced us that this country can and must do better to prepare for drought in the future. At our public hearings, dozens of people testified on behalf of urban and rural water associations, tribes, federal agencies, state and county governments, municipalities, livestock production and farmer associations, and conservation groups. With respect to U.S. Department of Agriculture programs, we heard similar criticisms from farmers, ranchers, and tribal representatives in Austin and El Paso, Texas, Atlanta, Georgia, Washington, D.C., and Billings, Montana. These people expressed concern that the application process for agricultural drought assistance programs is too cumbersome, that it takes too long to make decisions, and that placing federal decision-making outside the local level often results in disconnection among the applicants and the programs. Livestock producers consistently pointed out exclusion of their operations from agricultural assistance programs. Representatives from state, county, and local agricultural agencies noted communication and coordination challenges within the Department of Agriculture. On balance, we also heard about successful programs in the Department of Agriculture, the Bureau of Reclamation, and other federal agencies.

This testimony, combined with written comments submitted independently, helped identify gaps among federal, state, local, regional, and tribal programs and the people those programs are designed to serve. We also reviewed information and analyses prepared by the five Working Groups—agriculture; environment; municipal and industrial water; local government, community, and business; and monitoring and prediction—that we established to assist us in assessing state, regional, local, tribal, and federal drought programs and related laws. Nonfederal and federal experts in various aspects of drought comprised membership on the Working Groups and the Interagency Contacts Group, which coordinated the Working Groups and helped prepare this report. This work also identified gaps in service delivery.

The discussion below summarizes our findings. We emphasize that current programs may partially cover gaps in service delivery in some cases and more fully in some locations than in others. Yet, in many critical areas of drought preparedness, we heard that current federal programs do not provide any measurable assistance. Collectively, the gaps are significant and merit attention and remedies.

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The Commission met in Los Angeles, California, Scottsdale, Arizona, and Washington, D.C., and several times through teleconference technology. Public hearings were held in Los Angeles, California, El Paso and Austin Texas, Atlanta, Georgia, Billings, Montana, and Washington, D.C. All meetings of the Commission and all public hearings were announced in advance, according to federal procedures, and were open to the public.

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## PROGRAM ASSESSMENTS

### States

We learned that as of June 1999, 30 states had drought plans, with most of those oriented to response rather than preparedness. Two states had delegated drought planning to local authorities, and three states were developing drought plans. The states with larger numbers of people and resources at risk to drought tend to have more detailed state programs.

Five states reported that they have some drought funding mechanisms not tied to a federal administrative or presidential declaration of drought emergency. For example, Texas has a Community Development Program Disaster Relief Fund that can provide up to \$350,000 in grant money for small communities (less than 50,000 residents) to support their permanent water supply infrastructure.

Our assessments pointed out that in most states, drought responsibilities are normally located in the agencies that house the functions of agriculture, natural resources, water management, environment, or emergency management. Fewer than five states reported that they have individual designated drought coordinators, while more than 20 have drought task forces. Wisconsin, for example, lacks a specific drought plan but does use an ad hoc drought task force. One state, New Mexico, has completed a drought plan in conjunction with the Bureau of Reclamation, which provided assistance in developing the plan. Arizona and Hawaii are presently involved in a similar process with the Bureau.

In the state of California where there are several regional programs, such as the Metropolitan Water District's Water Surplus and Demand Management Program, a bill is pending before the state legislature to create a permanent drought management function at the state level.

Utah is one example of a state that approaches drought from several angles. In comments submitted to the Commission, state officials noted that state law related to flood control and drought emergencies grants Utah counties the authority to levy taxes and generate funds to aid in programs to increase precipitation. And Utah's Department of Agriculture and Food has a low-interest loan program available to assist drought-stricken farmers and ranchers. The loans help fund measures such as installation of pipelines, tanks, and troughs; construction and deepening of wells; development of springs or seeps; construction of tail water recovery pits for irrigation systems; and correction of conservation problems on farmland caused by severe drought. Department of Agriculture and Food officials suggested that in addition to current federal drought programs, federal assistance should be available to transport resources from areas not experiencing drought to areas that are in a drought.

In written comments and through testimony during the Commission's public hearings, state officials emphasized that federal assistance could go far to help localities and states prepare for drought, including assistance for planning and mitigation measures and to devise risk-management strategies. In their comments to the Commission dated February 2, 2000, the governors of Iowa and Missouri stated that "coordination among the various existing federal programs is necessary, as is coordination between federal agencies and the states." The two governors emphasized that such coordination is preferable to "new federal programs with regulatory authority over the states."

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In 1999, Kentucky experienced the driest July-September period in 105 years of record. Yet none of the water systems in the state required outside emergency assistance. Officials credit Kentucky's drought management planning program, adopted in 1993—a program that paid off through pre-drought water conservation measures and better preparedness for citizens and communities. The state provided financial and technical assistance as

well as detailed guidelines to assist communities in developing management plans. Those plans called at a minimum for water systems to project future water demand; evaluate the adequacy of water supplies and infrastructure; and, where gaps existed among current capabilities and future needs, determine the best means and the associated costs to meet those needs.

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### **Regional Entities**

There are several regional entities that either focus on drought or include drought as a major component of their work. As examples, the Western Drought Coordination Council presented the Commission with an impressive set of potential actions that focus on drought planning, impact-reduction measures, and effective response. The Interstate Commission on the Potomac River Basin has demonstrated that coordination and management of water resources on a regional multi-jurisdictional basis during drought periods can allow a major metropolitan area to sustain itself. The Susquehanna River Basin Commission presented the opportunity for major water users and other interested parties to assess the effectiveness of drought management measures, list the lessons learned in managing drought, and compile and distribute the findings to key decision makers. The Tarrant Regional Water District (Texas) incorporates simulated drought exercises as a training tool in its drought planning.

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The six-county, multi-municipal Metropolitan Water District of Southern California incorporates drought planning and preparedness in its comprehensive Integrated Resources Plan and Water Surplus and Demand Management Plan. The District emphasizes citizen and customer participation in water conservation as well as long-term water supply and resource management programs for a region receiving 10 to 15 inches of rainfall in an average year. Metropolitan's plans ensure reliable water supplies for more than 16 million people (municipal, industrial, commercial, and agricultural uses) despite weather, regulatory, or disaster-based drought pressures. The southern California region has spent \$8 billion for water conservation, recycling, and storage projects since 1982, and those investments appear to be paying off. As a result of aggressive conservation, the region is using less water today than in 1975, even though the population increased by five million people from 1975 to 1999.

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### **Localities**

A sample survey of county officials conducted by the National Association of Counties (NACO) in 1999 indicated that county governments primarily rely on federal programs for drought assistance. Seventy percent of the 190 respondents indicated that they use federal programs to respond during drought emergencies. Even though this represents a small sample of the 3066 counties across the country, it is a starting place to understand local government needs.

Fifteen percent of the 190 respondents have county or city drought assistance programs that include drought emergency response as well as water conservation plans incorporating drought contingency procedures. Most counties have emergency procedures for disasters, including drought, and have established communication channels to get emergency information to their populations.

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Counties with drought or drought-related assistance programs include:

|                         |                             |                                |
|-------------------------|-----------------------------|--------------------------------|
| Graham County, Arizona  | Bannock County, Idaho       | Muskingum County, Ohio         |
| Navajo County, Arizona  | Lake County, Indiana        | Lancaster County, Pennsylvania |
| Yuba County, California | Becker County, Minnesota    | Williamson County, Texas       |
| Chatham County, Georgia | Becker County, Minnesota    | Gloucester County, Virginia    |
| Fayette County, Georgia | Yellowstone County, Montana | Dane County, Wisconsin         |

County officials must try to manage fragmented federal assistance programs to help their constituents. Links may exist between the Department of Agriculture and farmers through Cooperative Extension offices, Farm Service Centers, and Resource Conservation and Development Councils. But coordination and communication may not be efficient, or extend beyond traditional agricultural users, especially during a drought emergency. The Commission heard considerable testimony from county and other local officials that these linkages are often laden with bureaucracy, delays, and program guidelines that do not reflect environmental, resource, temperature, and climate variability across the country. In Billings, Montana, for example, the important drought-related factor of wind is not included in the assessment process. In addition, many people testified to the significant lack of weather and streamflow gages and data in general that are needed to substantiate, review, and make decisions about their applications for agricultural assistance.

Counties, towns, and rural areas are facing suburban growth and development. The U.S. Department of Agriculture's 1997 National Resource Inventory found 16 million acres of forest, cropland and open space were converted to urban and other uses from 1992 to 1997. To provide public health, safety, and welfare services, counties with increasing populations must be able to plan for future needs. A local government's ability to plan for drought is dramatically improved if technical data, tools, and resources are available.

Local governments must also inform and educate their constituents of the need for drought planning, especially when an emergency is not imminent. Many local governments have public information programs on water resources that could be supplemented with information about drought. The Georgia Water Management Campaign, described below, is an example of both a method of delivery and the types of tools and information local officials need.

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At the Commission's hearing in Atlanta Georgia, County Commissioner George Bird (Candler County, Georgia) described the Georgia Water Management Campaign. The Campaign's mission is to enhance the abilities of local governments to manage and protect water resources by translating water management policies into local government decision-making capabilities, guidance, and technical assistance. To achieve this mission, the Campaign developed outreach tools such as public service announcements, videos, and descriptions of local government case studies and convened summits on water issues for local officials. The Campaign's 21 members of the Local Government Advisory Board serve as ambassadors and provide overall guidance. The Campaign was created through a partnership among the Georgia Environmental Protection Division, Georgia Environmental Facilities Authority, and the Association of County Commissioners of Georgia. As County Commissioner Bird said, "Water issues are a developing priority for local governments. Education and public input are key to local decision making."

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Communities can plan to minimize impacts when a drought reduces water supplies. With the exception of the late 1980s and early 1990s in southern California, droughts have not created a potable water emergency in large cities since the 1960s, in part because of the amount of planning large cities do. But emergency conditions—not enough water for minimal household uses—may still arise when droughts are longer or more severe than anticipated or when other factors unexpectedly interrupt or pollute water supplies.

Some cities use data from the U.S. Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA) in developing and implementing their plans. And federal water

agencies can sell space in existing federal reservoirs for urban water supplies. In cities near such reservoirs, this may be the least expensive way to get more water.

Small communities and the millions of “self-supplied” Americans, who rely on their own wells, are likely to have problems during prolonged drought. Small water systems tend to be vulnerable because they have only one source of water, and such systems are also likely to face high per-customer costs to meet the latest federal safe drinking water standards. These factors have encouraged the takeover of small systems by large systems where it is economically feasible. But areas with very low population density remain at risk. Some small communities may be able to modify existing watershed structures, initially designed only for flood control, to also provide storage for municipal and industrial water.

At the Commission’s public hearing in Atlanta, a researcher who had just completed a survey of drought management planning in the Southeast described some basic elements of planning that could be implemented by local governments for a few thousand dollars. She echoed the comments of many others who testified that cooperation and assistance from states and the federal government through incentives, funding, and technical assistance in drought planning would go far to help small communities and rural water systems prepare better for drought.

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The Commission was informed of various drought mitigation activities developed at the local level, often in partnership with state and federal agencies through technical and financial incentive programs. In Los Angeles, “Second Nature: Adapting LA’s Landscape for Sustainable Living” is a program run by the nonprofit TreePeople organization. In focusing on urban landscape retrofits such as planting trees and adjusting runoff patterns for residences and commercial buildings, TreePeople reinforces the principle that locally developed solutions can be effective.

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## **Tribes**

Native Americans are involved in many water use issues. Dominant uses of water include water for agriculture (irrigated and non-irrigated), recreation (including revenue from concessions associated with recreation uses), municipal and industrial (including drinking water and water for hotels and gaming), social, cultural, and religious uses. Tribes also support water use for fish and wildlife and other environmental purposes.

There are approximately 560 federally recognized Indian tribes located within the United States—306 in the conterminous 48 states and 289 of those west of the Mississippi River, where 95 percent of all Indian trust land is located. The Department of the Interior notes that tribal lands, including official reservations, currently cover about 55 million acres, or roughly three percent of the country except for Alaska and Hawaii. The largest area is the Navajo Nation, while some federally recognized tribes have no land. The states with the highest Indian populations are Oklahoma, California, Arizona, New Mexico, and Alaska.

By any measure, the scope of tribal drought issues in the West is immense. Tribes have experienced the vagaries of climate on this continent for many thousands of years, and more recent times have proved to be no exception. Flexibility was the key to adaptation and relative self-sufficiency in earlier times. When the ability to cope in one place was exceeded, Indian tribes moved, later returning when climate permitted. Since the loss of many of their ancestral lands, however, such flexibility is no longer possible for the tribes.

Some tribes are turning to planning as a viable means of lessening the impacts of drought on tribal

lands and populations, others expressed their concerns that criteria for national drought policy might compromise their cultural or religious beliefs, and they specifically asked that this not occur. Some tribes were also reluctant to disclose water-related information because of ongoing negotiations over water rights. They asked that any national drought policy be sensitive to these issues and that the Commission uphold the special relationship that tribes have with the federal government.

As a result of our outreach effort, we found that six tribes—the Hopi Tribe, Hualapai Nation, Kaibab-Paiute Tribe, Navajo Nation, San Carlos Apache Tribe, and Zuni Pueblo—are in the process of developing drought contingency plans through cooperative agreements with the Bureau of Reclamation. Based on these experiences, developing drought plans can cost from \$25,000 to \$200,000.

But in Billings, Montana, representatives from seven tribes consistently reported frustration in not being able to rely on the procedures and processes associated with the “Government-to-Government” Executive Order signed by the President and described the bureaucratic quagmire associated with the Bureau of Indian Affairs. Most tribal representatives explained that current programs require modifications in eligibility criteria and cost-share rates to address specific tribal situations, and that the programs must be adequately funded.

We learned from comments submitted by tribes from Florida to Oregon and from the Inter-tribal Agriculture Council that many tribal lands lack current soil survey, streamgaging, and range condition information. Such information is critical to basic planning as well as drought planning and is needed to gain access to federal assistance programs. Some tribes indicated that they lack access to snow amount, soil moisture, and stream flow information needed in planning and for triggering emergency response efforts. Many tribes noted the need for technical and financial assistance to plan and implement conservation measures such as wells, springs, and ponds for livestock water; cross fences for grazing management; and other practices to enhance wildlife and protect against wildfire. They emphasized that this assistance must be easily and locally accessible to tribal members.

## **Federal Government**

We found that 88 drought-related federal programs were funded within the past 10 years. We classed those programs into four broad program categories: (1) preparedness, including planning and mitigation; (2) information, including monitoring/prediction and research; (3) risk management; and (4) emergency response. Seven of these programs provide assistance for drought planning, 42 for drought mitigation, 22 for drought-related monitoring/prediction and research, and 47 for response. These numbers total more than 88 because some programs cover more than one facet of drought. For example, some of the mitigation programs also contain drought planning and response elements.

*Planning.* The need for long-term plans related to disaster assistance in general was made clear in a 1995 Senate report, which suggested a shift in policy from emergency response to planning and mitigation measures (Senate Task Force on Funding Disaster Relief, March 1995). Planning and mitigation strategies underlie much of the work of some nonfederal drought-related entities, such as the Western Drought Coordination Council and Delaware River Basin Commission. The law that created this Commission emphasized planning and mitigation as critical to reduce the need for relief.

Many people who commented during all of our proceedings recognized the importance of comprehensive long-term strategies that incorporate drought planning and plan implementation as well as mitigation measures such as urban water conservation programs and water-efficient agricultural irrigation practices.

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Yet, we found that Congress has granted only one program with specific authority for drought planning and educational or technical assistance within the three federal entities having the greatest federal responsibilities when drought occurs—the U.S. Department of Agriculture, the Bureau of Reclamation, and the U.S. Army Corps of Engineers. Public Law 102—250 authorized the Bureau of Reclamation’s Drought Program to assist states, tribes, localities, and nonprofit entities in developing comprehensive plans. Until very recently, these efforts were funded from emergency or supplemental funds. In its Fiscal Year 2000 budget, the Bureau requested \$500,000 for the program. Congress appropriated \$3,000,000, but earmarked that amount as follows: “...shall be made available primarily for leasing of water for specified drought related purposes....” The Bureau also requested \$500,000 in its 2001 budget.

Public Law 92—251 allows the U.S. Army Corps of Engineers to develop water resource plans for states, tribes, and territories. The plans can cover any aspect of water and water-related land issues, including drought preparedness if that is what a state or tribe wants. Funding is limited to \$500,000 annually for each state or tribe. Individual studies (there may be more than one per state or tribe per year) generally cost \$25,000 to \$75,000, an amount that is split 50-50 between the state or tribe and the Corps. Topics of studies conducted in recent years include water supply and demand, water quality, environmental conservation/restoration, wetlands evaluation, dam safety/failure, flood damage, flood plain management, coastal zone management/protection, and harbors/ports. This Corps program funded the preparatory work that preceded the “Virtual Drought” exercise (noted earlier) in Tarrant County, Texas.

The 1935 Soil Conservation Act authorized the U.S. Department of Agriculture to provide assistance for individual farmers and ranchers to develop and implement conservation plans. This legislation responded to the persistent drought of the 1930s and the resulting “Dust Bowl” caused by severe wind erosion. For 65 years, hundreds of thousands of farmers and ranchers have received technical and financial assistance to address critical resource needs. Under this voluntary program, assistance is provided at the request of the farmer and normally for specific needs such as erosion problems that the farmer identifies.

Limited authorities and funds as well as lack of coordination among and within federal agencies hinder these planning efforts. The major gap already identified in the Bureau of Reclamation’s Drought Program is that the requests for planning assistance far outweigh available funds and that the law does not allow the Bureau to provide financial assistance to the requesting entities. The Corps of Engineers water resource planning program is not specifically targeted to drought needs, and drought is not receiving much attention in these efforts. The U.S. Department of Agriculture’s local and tribal offices reach just a small number of the people needing and requesting assistance because of limited resources and witnesses told us because of program bureaucracy and lack of coordination among federal, state, county, and regional entities within the Department. Tribal representatives said that in most locations, assistance is not locally available. They expressed appreciation for the current Department of Agriculture effort to place offices on tribal lands, but stated they are far behind their non-Indian counterparts.

We heard, too, that developing a drought plan or incorporating drought concerns into a more comprehensive water management plan is of little value unless the plan is implemented. Successful implementation of plans requires practice, particularly when the people who are responsible for responding

to drought may not be the same from drought to drought. Enough time passes between droughts that the issues change, water use changes, and professional staff members retire or move to new jobs. Many of the entities involved in drought response during the late 1990s, for example, were also involved in drought response during the late 1980s, but very few of the same people were still participating. As the Army Corps of Engineers has discovered and told us, communities need to prepare plans for drought and then exercise them, like fire drills, to keep the plan up to date and train new staff.

**Mitigation.** Mitigation is often associated with actions taken after the fact to remedy damage caused by human or natural disturbances. In the context of this report, we use the term mitigation to describe actions taken prior to and during drought events to reduce potential impacts and thus reduce the costs of responding to drought. As such, mitigation is an essential element of drought preparedness.

Drought mitigation comprises a broad range of proactive measures—from actions that individuals take such as installation of livestock watering ponds on ranches to state-of-the-art wastewater treatment that allows reuse of water. We observed an example of such technology at the Scottsdale Water Campus in Arizona and heard about other wastewater treatment and reuse programs from witnesses during our Los Angeles hearing. These types of measures may be aimed specifically at reducing the potential impacts of drought. Or, they may be used to expand water supplies for growing populations, in which case the larger population may still need to plan the mitigation of drought impacts.

Within federal government programs, we found that water supply and droughts are considered together. As one example, the Bureau of Reclamation's 2001 budget includes significant amounts for water delivery projects that can help reduce the impacts of drought. These include \$65.3 million for the Central Valley Project in California, \$33.7 million for the Central Arizona Project, \$29.7 million for the Mni Wiconi Project in South Dakota, and \$21.3 million for the Garrison Diversion Unit in North Dakota. The budget also contains requests of \$22 million for water reclamation and reuse and \$2.2 million for the Bureau's small projects loan program. In addition, the Bureau's water conservation program and guidance in the Bureau's tiered pricing handbook has helped several localities carry out water conservation measures to reduce their vulnerability to drought, including tiered pricing strategies.

The U.S. Army Corps of Engineers' total civil works budget for Fiscal Year 2000 is \$4 billion (plus \$332 million from nonfederal and trust fund receipts). The budget includes \$137.7 million for general investigations, nearly \$1.4 billion for construction, and \$1.9 billion for operation and maintenance. The Corps addresses drought as part of the hydrologic spectrum in its design of projects, including environmental restoration projects, and in the operation of its existing projects. But the Corps has no authority or funding specifically for drought planning.

A number of programs within the U.S. Department of Agriculture provide assistance for actions that can lead to drought mitigation, although none are specifically funded for this purpose. The 1954 Small Watershed Act, for example, gave the Department authority to help rural communities address natural resource concerns in small watersheds (less than 250,000 acres in size). Eligible purposes include flood control, watershed management, water conservation, municipal and industrial water supply, recreation, and fish and wildlife protection. Although the program has broad authorities, a high percentage of the funding has gone to assist local communities install flood control measures. There is currently a backlog of requests for assistance totaling nearly \$2 billion. The annual appropriation is approximately \$100 million.

In 1964, Congress passed the Resources Conservation and Development Act to assist local units of government address erosion problems, water management problems, and economic development needs.

This program provides technical and financial assistance, but available funding has been limited to technical assistance for local Resource Conservation and Development Councils. The annual appropriation of about \$36 million provides each Council with a coordinator position and clerical support.

The 1985 Food Security Act directed the Secretary of Agriculture to enroll 45 million acres of highly erodible lands into the Conservation Reserve Program. This amount was reduced in subsequent farm bills to 36.4 million acres as a cost-savings measure. Farmers receive technical and financial assistance as well as an annual rental payment for installing and maintaining this land in permanent vegetative cover.

In 1996, Congress consolidated several of the Department's cost-share programs and created the Environmental Quality Incentive Program. The primary purpose of this program is to help farmers address their water quality problems, but it also provides technical and financial assistance for the installation of water conservation measures as well as livestock watering facilities. Cost-share is provided through long-term agreements that address an entire farm's resource needs. But at the Commission's public hearing in Billings, Montana, public witnesses said that the procedures related to this program limit their ability to obtain financial assistance to install drought mitigation measures such as cross fencing and livestock water development.

***Monitoring/prediction and research.*** About 22 federal programs have some responsibility for drought monitoring/prediction and research. In relation to monitoring and prediction, these include programs that focus on weather patterns, climate, soil conditions, and streamflow measurements. Examples are three networks—the Department of Agriculture's Soil Climate Analysis Network (SCAN)/Snow Telemetry Network (SNOTEL), the National Oceanic and Atmospheric Administration/National Weather Service's Cooperative Observer Network (COOP), and the U.S. Geological Survey's streamgaging and groundwater monitoring network. The U.S. Army Corps of Engineers both uses and supports non-Corps federal monitoring systems and has developed its own remote data sensing network to manage its reservoirs.

We heard, however, that such programs are not always available in some areas such as on tribal lands and in remote rural areas. A case in point is the U.S. Geological Survey's streamgaging and groundwater monitoring network. This finding echoes a conclusion reached by an external task force recently assigned to review the Survey's Federal-State Cooperative Water Program. The task force's report (1999) stated, "Current funding for the Cooperative Water Program is not adequate to satisfy all of the needs identified for additional streamflow data, regional groundwater information, updated hydrologic needs and technical publications."

Federal monitoring/prediction programs often join with universities, private institutions, and other nonfederal entities to provide information needed for effective drought preparedness, risk management, and response. For example, federal programs provide the basic data used by private weather services and other enterprises that play a vital role in supporting farmers and others who are vulnerable to drought. The private weather services use the federally supplied data in detailed predictions that can be tailored to individual farmers and can cover varying time periods as needed. Some private services are using remote-sensing technology that can show farmers areas of crop stress, allowing them to make more efficient decisions about applying fertilizers or irrigating. Such programs should help address the needs of farmers who told us that they rely on irrigation systems and need detailed, localized information (soil moisture, temperature, wind, humidity, evapotranspiration rates) for irrigation scheduling.

As the Western Drought Coordination Council stated in its comments to the Commission, basic weather, water, soil moisture, mountain snow amount, and climate observations are the foundation of the monitoring and assessment activity that alerts the nation to impending drought. The current federal

interagency effort to indicate likely drought trends two weeks ahead of time on the drought-monitoring map is a start. But we heard that longer-term predictions would improve services, including prediction maps of drought locations in the medium range (ten days or two weeks) and one to two seasons in advance. The Climate Prediction Center is producing an experimental two-season drought forecast map, which schematically displays likely changes in drought over the next two seasons. Proper use of this product, we were told, depends on a careful explanation of its limitations.

We also heard that the wealth of monitoring and prediction information produced by federal programs and in conjunction with nonfederal partners creates a problem for some users. As noted earlier, we heard from tribes that the information is not well distributed. And we heard that drought information and data are often complex and, for the most part, are not currently presented in a standardized format. Such data can also be difficult to find and interpret. This is especially true for individuals, small businesses, and some communities and tribes that do not have ongoing relationships with drought management agencies. Many witnesses at our hearings and written comments submitted independently to the Commission indicated a need for an accessible “gateway” (point of contact) where high-quality, standardized, comprehensible current information and historical data are managed.

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The Commission found that there are various materials and information resources to assist with drought planning, training, technical assistance, and technology sharing and transfer. We note the resources and information available through the National Drought Mitigation Center, which have been developed in partnership with other nonfederal and federal entities. One of the Center’s products is the U.S. Drought Monitor, produced in coordination with the U.S. Agriculture and Commerce departments, which is a map of the drought outlook in this country. The Drought Monitor is updated regularly and is available on the internet. The Center, through its involvement in international drought issues, also catalogs resources related to drought policy development around the world. This allows for sharing of information on new approaches to drought management in a timely manner. Witnesses at several of the Commission’s public hearings indicated that the Center has been helpful in identifying additional professionals with expertise in drought preparedness, research, monitoring, and response activities.

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In relation to research, we found that this country is blessed with a tremendous storehouse of drought-related scientific and technical know-how. Research programs of the National Oceanic and Atmospheric Administration, the Department of Agriculture, the Department of the Interior, the Environmental Protection Agency, numerous universities, and private institutions—as well as work at the National Drought Mitigation Center—form the basis of knowledge needed to monitor drought and to address the occurrence of drought and its impacts.

The U.S. Army Corps of Engineers is also involved in drought-related research. During the National Drought Study (1989-1993), for example, the Corps sponsored research and experimentation on many aspects of drought, including: (1) development of the National Drought Atlas in partnership with IBM and the National Climate Data Center; (2) a report on the lessons learned in the California drought regarding public response, water marketing, water curtailment, and agricultural and urban impacts; (3) a compendium of drought planning and related issues (water law, economic and environmental impacts, hydrology, water conservation, politics, alternative dispute resolution, and more); and (4) institutional analysis of a severe sustained drought on the Colorado River published under the Man and the Biosphere project.

We heard often that research and technology transfers are key to effective drought planning, mitigation, and emergency response and to drought-related technical assistance and training.

Important drought-related research areas include drought planning and technical communications as well as sciences such as climatology, hydrology, plants, and soils.

Our analysis indicates that research has proved essential in several arenas. As examples, non-irrigated crop and forage production, which is totally dependent on rainfall, has benefited from research that identified germplasm and dominant genes in naturally occurring drought-tolerant plants. Options for farmers and ranchers to adjust their cropping systems in response to drought predictions may be expanded through research that develops novel genes and gene systems to enhance drought-resistant or drought-tolerant species and that helps uncover the secrets of ecosystem processes, particularly as they relate to drought.

Research has identified characteristics of impacts resulting from changes in weather patterns such as El Niño, La Niña, and the North Atlantic Oscillation. Additional research will lay the foundation for developing strategies to cope with those changes. Research has provided the basis for technology needed in long-range weather predicting. Acquisition of improved data on climate and weather phenomena can help improve the accuracy of those predictions.

Research results in information needed by individuals, communities, states, and regions to facilitate more efficient water use. Continued research can supply the most up-to-date, accurate information possible for those strategies. Research has been the impetus for improvements in irrigation efficiency. Continued research can help determine how to improve storage of natural precipitation for both agricultural and non-agricultural uses.

Exchanges of information among planners and decision-makers have helped determine the direction of drought-related research, and sharing of findings among research entities has helped promote many of the advances in drought-related research. The Commission heard that there are various opportunities to expand such collaborative and cooperative activities. We also heard that research benefits greatly from trained, skilled people who have a deep and abiding interest in drought-related issues. As technology and knowledge evolve, so does the need for a new generation of trained, skilled, and interested individuals.

***Risk Management.*** It is evident from the information we received and assessments we conducted that even the best preparedness and mitigation measures will not adequately address some drought-related risks. Small businesses such as marinas and water-based recreation businesses, for example, are vulnerable to the impacts of drought as much of their cash flow is dependent on standing water levels or streamflows. In addition, in communities that depend heavily on agriculture or water-based recreation, a loss of cash flow to these businesses results in a similar income loss to the main street businesses that depend on them. The Small Business Administration notes that while business interruption insurance is available in the private insurance markets, it is generally not tailored to the needs of small businesses in drought situations. Small businesses may also lack knowledge of financial and business risk-management strategies available to them.

Farmers and ranchers are also among the first to feel the impacts of drought and, in many cases, are the most vulnerable to those impacts. For several decades, the U.S. Department of Agriculture has offered crop insurance to farmers as the government's major risk-management strategy. Federal crop insurance covers all major field crops in nearly all locations, but it does not extend to all vegetable and other crops in all location nor does it cover livestock. Further, many farmers told us that payments are often "too little, too late."

A variety of risk-management strategies were offered for the Commission's consideration, many of them variations on the crop insurance program but with emphasis on self help, extended coverage, resource stewardship, and preparedness. While the Commission endorses none of them, we present the following summary.

- One approach called for incorporating all crops and livestock into the crop insurance program and for taking a “whole-farm” approach to insurance that means losses from one crop or one type of livestock could be offset by gains in a different crop or type of livestock on the same farm.
- Another approach discussed at the Commission’s hearings in Austin, Atlanta, and Billings would replace the current crop insurance program with one based on the cost of production. Under this program, all crops and livestock would be included on a whole-farm basis. The federal government would subsidize premiums, but at different rates than under the current program, and payments would be made when income is less than 90% of the documented cost of production. Paid premiums would be maintained in a national trust fund for disbursement.
- A third option was to base payments from the crop insurance program on the same criteria used to make direct payments to farmers for resource conservation measures under the Conservation Security Program proposed in the Administration’s 2001 budget. The objective is to recognize farm and range lands and water on farms and ranches as valuable assets in addition to the crops and livestock raised on these lands.
- In counties of Florida, Michigan, Massachusetts, and several other states where farmers often produce a variety of specialty crops, the Department of Agriculture is testing the Adjusted Gross Revenue model. This insurance plan incorporates the whole-farm approach and uses a farmer’s historical Schedule F tax form information as a base to provide guaranteed revenue during the period of insurance coverage. This model provides an insurance safety net for multiple agriculture commodities in one insurance package.
- A different approach stems from the Australian Drought Policy Review Task Force’s report issued in 1990. The Task Force’s goal was to achieve self-reliance among farmers and recommended that only in extreme circumstances—a one in 20- to 25-year drought event that lasts 12 months—would the government provide aid in the form of debt subsidies and income support. The respective roles for farmers and the government were clearly spelled out. Farmers would assume greater responsibility for managing risks arising from climate variability while the government would help create an overall environment conducive to this planning and risk-management approach. The government would increase funding for drought research and training on drought risk management and provide savings incentives and tax policy changes. The Australian approach does not include provisions for government crop insurance.

Public testimony at the Los Angeles hearing and comments from the Army Corps of Engineers pointed out that risk management has a different connotation for stored water droughts. As the Corps notes, there is no equivalent seasonal gamble. Building a reservoir on a stream is intended to increase the dependable water supply yield. Based on the size of the reservoir and the stream, a reservoir can make supplies during the worst droughts almost as great as the average natural streamflow. For many reservoir systems, however, the dependable yield is not enough to fully satisfy all needs. In these cases, system managers develop drought contingency plans that call for the staged curtailment of the least important uses of water (such as lawn watering) during droughts. Communities may elect to accept these drought-related reductions rather than add reservoir capacity to meet growing needs because the creation of the reservoir has even less desirable effects. Risk management for these systems addresses the probability of system failure, the uncertain effectiveness of drought curtailment measures, uncertainty in estimates of drought severity and duration, and the tolerance of utility customers for water use curtailments. These risk assessments are very common, and at best, are based on sophisticated models of water curtailment effectiveness, reservoir simulation and optimization models, and drought statistical analysis. The Corps of Engineers has drought contingency plans in place at all of its projects, but has rarely had to test their effectiveness.

**Response.** Many comments we received recognized the importance of moving away from the traditional approach to drought that is driven by emergency response to a new, proactive drought policy emphasizing planning and mitigation. At the same time, we were cautioned that it will take time to provide the training and technical assistance needed to help farmers, ranchers, local businesses, communities, states, and tribes make this transition. A safety net is needed, we were told, to help overcome the impacts of extreme occurrences of drought or the impacts of multi-faceted disasters (for example, flood/drought or hail/drought).

Approximately 47 federal programs have an element of drought-related response, primarily for agricultural droughts. The U.S. Department of Agriculture, for example, follows a “bottom up” procedure for emergency disaster designations. In every county in the nation, there is a County Emergency Board consisting of a representative from each of the five Department of Agriculture agencies that normally have offices in the county. A similar structure exists at the state level. When a state governor gets a request for a disaster designation related to agricultural issues, such as drought, the governor asks the Secretary of the Department of Agriculture to designate an administrative disaster. The Secretary sends the request to the national office of the Farm Services Agency. From there, it goes back to the State Emergency Board, which works with the relevant County Emergency Board(s) to analyze the situation and determine whether or not conditions exist for the disaster designation.

The Department of Agriculture also has several ongoing and ad hoc programs that provide financial relief to farmers who have suffered drought-related losses. The Emergency Conservation Program, the Emergency Watershed Program, the Non-insured Crop Disaster Assistance Program, and the Federal Crop Insurance Program are examples of such programs. Other emergency relief requires congressional action and is dependent on the appropriations process or emergency supplemental appropriations. The funding for drought, floods, and economic assistance approached \$16 billion over the past two years.

But many agriculture producers expressed concerns about these types of responses. For example, a farmer who testified at the Commission’s hearing in Austin experienced a significant drought during the summer of 1999. He finished harvest in August, but the Farm Services Agency could not take his application for assistance until December. By February of 2000, assistance was still not available. During the 1999 drought in the mid-Atlantic and southeastern states, the Department of Agriculture under the secretarial disaster designation could only provide assistance through the Emergency Conservation Program and process loan applications pending congressional appropriations.

Public witnesses at the Commission’s hearing in Billings said that documentation acceptable to trigger federal response for one Department of Agriculture emergency program was not sufficient to trigger other Department emergency programs. They said that they often fail to get a clear understanding of what additional information is needed to meet program criteria and that this causes confusion for everyone, including the agency staff administering the program. And witnesses at several of the Commission’s hearings said that they were frustrated by the Department’s Emergency Conservation Program. That program can help them develop emergency livestock watering facilities in times of dire need, but the program seldom provides timely assistance. This may be due in part to the fact that the program is funded by supplemental appropriations from Congress after the fact.

The Bureau of Reclamation has the authority through Public Law 102—250 to provide emergency response assistance including emergency well drilling, but this assistance is available only within the 17 so-called “Reclamation” states in the West. This law also authorized water deliveries “from Federal Reclamation projects and non project water...on a non-reimbursable basis for the purposes of protecting or

restoring fish and wildlife resources.” Public Law 102—250 is also the basis for the Bureau’s drought planning and education assistance. All of these activities must therefore share the funds for this program.

Public Law 95—51 provides the Secretary of the Army authority under certain conditions to construct wells and transport water to farmers, ranchers, and political subdivisions within areas that the Assistant Secretary of the Army for Civil Works determines to be drought distressed. Any farmer, rancher, or political subdivision within a distressed area may submit a written request for assistance. But Corps assistance is considered only when nonfederal interests have exhausted reasonable means for securing necessary water supplies (within the limits of their financial resources), including assistance from other federal agencies. And Corps assistance is always considered to be supplemental to state and local efforts. For example, Corps assistance is not used to provide drought emergency water where a livestock owner has other options such as taking out a loan, selling all or part of a herd even at deflated prices, and relocating animals to an area where water is available. As another example, Corps assistance can be provided to construct wells, but the Corps’ costs for construction must be repaid. In addition, Corps assistance can be provided to transport water for consumption. The Corps covers the cost of transporting the water, but the cost of purchasing and storing the water is the nonfederal interest’s responsibility. This water hauling program, which seems to offer assistance at first glance, is actually a program of last resort under the current law, with very restrictive eligibility criteria.

The 1966 Flood Control Act allows the Corps to contract with states, municipalities, private entities, or individuals for surplus water that may be available in any reservoir under the control of the Department of the Army. Withdrawals are for domestic and industrial uses. The preferred approach in providing such surplus water is for a state or subdivision of a state to enter into a contract with the Secretary of the Army and agree to act as wholesaler for all of the water requirements of individual users. This places the state or local government in a position to help their citizens during difficult times and minimizes the potential for problems that could arise if the Secretary of the Army had to determine who is entitled to shares of surplus water based on assessments of local needs. All such withdrawals require a fee for the service provided, even in the case of a declared national disaster area.

The Stafford Act and its implementation by the Federal Emergency Management Agency (FEMA) is an effective, proven model for organizing and providing emergency assistance during most catastrophic natural disasters. One of the factors that makes this program successful is that FEMA can draw monies from a standing fund to pay for disaster assistance. FEMA can provide disaster unemployment assistance, truck in water, and assist in replacing or building infrastructure such as wells or pipelines for water transfers. But the Stafford Act does not include agriculture. In addition, it takes a presidential declaration of disaster before Stafford Act authority can be activated. Not all drought events will be declared disasters at the presidential level, although they may well have adverse impacts.

## **NEED TO COORDINATE DROUGHT-RELATED PROGRAMS**

As shown in much of the preceding discussion, the array of state, federal, and other drought-related programs can be intimidating and frustrating for those who would like access to the services the programs offer, but who do not deal with government agencies on a regular basis. At another level, the multitude of federal programs can also cause problems for state, county, and tribal governments that may be very used to governmental transactions but still have to deal individually with separate federal agencies for any number of drought-related issues.

*Service delivery networks exist for many drought-related programs at all levels of government.*

However, we heard that they are not well integrated, and the people who need the information about the programs are not always well served. People told us there is no central point of contact concerning all federal programs and that even within the same federal department, there may be many drought-related programs and no single contact point to advise people about what they may qualify for or how to access the programs. We also heard that the delivery time for assistance in many cases is unsatisfactory, partly because there is little coordination of programs.

The Western Drought Coordinating Council strongly suggested establishing a federal drought coordinating body. And, as the law that created this Commission indicates, there is definitely a need to develop an effective coordinated federal approach to drought mitigation and response. The law required us to determine if all federal drought programs should be consolidated under one entity. We considered that option and decided against consolidation (see the discussion preceding Recommendation 5.1).

### **NEED FOR PUBLIC EDUCATION**

We heard often during our deliberations that a key element in successful drought preparedness is public education. Many people are made aware, sometimes rudely, of the need for water conservation and other measures during drought. But once drought is over, old habits tend to dominate.

Public education is an underlying theme in much of the preceding discussion in this report. Most examples of successful public education campaigns presented during our hearings stemmed from local and state governmental activity or from private and nongovernmental entities. As an example, the California Urban Water Conservation Council identified 16 best management practices, two of which relate to education, public awareness, and communications. One calls for organizations to identify a “conservation coordinator” as a single contact point for information. The other calls for development and implementation of coordinated public and school education programs, including workshops, newsletters, public service announcements, press releases, town hall meetings, school curricula, bill stuffers for utilities, and interactive participatory decision-making processes. These techniques and others provide communication links among organizations that provide assistance and the people that they serve. They also help increase awareness of the value of preparedness and planning to reduce costly impacts of droughts.

There is little federal assistance available for such programs, but there are a few examples of federal public education efforts related to drought. One is the National Weather Service’s recent addition of drought concerns to its annual spring media briefings on the water supply outlook. For the March 13, 2000 presentation, the Service prepared a public document to emphasize the importance of preparing for drought. In addition, the Service produced maps to show current drought areas nationwide as well as seasonal drought outlooks and provided a list of drought information sources. On another front, the National Disaster Education Coalition, a group of public and private organizations that provides educational materials and information on natural hazards, met in February 2000 to discuss a plan for incorporating drought into its ongoing efforts.

### **NEED TO ADDRESS ENVIRONMENTAL CONCERNS**

As many people testified during our hearings or through written comments, drought can have devastating impacts on aquatic and terrestrial environmental resources, as well as on human users of water. We learned that aquatic ecosystems are exceptionally vulnerable to the effects of drought conditions, manifested as reductions in streamflows, and populations of terrestrial wildlife are placed under stress when

severe drought conditions develop. Habitat quality and quantity gradually decline from lack of moisture, increasing the competition for limited resources. Wildlife species eventually suffer from lack of drinking water, forage, and cover and from heat stress. As the report from the Commission's Working Group on the environment noted, the biotic impacts of drought are particularly acute for threatened, endangered, and sensitive species of fish and wildlife that are characteristically found in low population densities. In many cases, such species have already encountered damage to or destruction of their natural environments because of factors such as suburban sprawl, conversion of land to agricultural or industrial uses, and construction of large dams or other impoundments.

We heard that in areas where large quantities of water are stored behind dams, the dams segment rivers, thus impeding the movement of fish and changing the pattern of sediment deposition. Dams also allow the regulation of river flows, and the preference is generally for moderate flows with no floods and no low flows. Riverine ecosystems that evolved before the dams were built and the life they sustain may be eliminated. The most common examples are anadromous fish that can no longer navigate the river and riverine species whose food cycle depends on the frequent flooding of riverbanks. But dams also eliminate some of the effects of severe droughts, so species that could not survive as well in the natural hydrologic cycle may now prosper. New species, welcome and unwelcome and that only exist if there are lakes, may be introduced.

Drought also has repercussions on the morphology and hydrologic function of stream channel networks and on the chemistry and water quality of streams and lakes. On land, it can lead to major episodes of tree mortality, initiate outbreaks of insects and disease in forests, and limit an ecosystem's productivity and ability to cycle essential elements.

Witnesses noted that environmental resources often receive inadequate attention during drought emergencies and in drought planning, not so much because of lack of concern but because of lack of expertise in this arena, lack of adequate financial resources, and sometimes lack of awareness. Drought planners often fail to determine which drought-related environmental impacts can be tolerated and which cannot and therefore would benefit from appropriate drought impact-reduction measures. Larger questions also remain to be answered, including the degree to which humans should try to eliminate the effect of drought on the environment if drought is a natural part of the environmental cycle.

Additional concerns center on use of water for humans and the environment, including minimum stream flows for wildlife species, and determination of preferences when one species competes with another for water. Some entities suggested that during drought, environmental regulations ranging from those concerning wildlife and wildlife habitat to those related to safe drinking water should be more flexible. On the other hand, we heard that droughts are the very times when enforcement of such regulations is essential to protect environmental resources, including drinking water supplies, that are already stressed from factors not related to drought. We heard too that addressing environmental concerns in relation to drought might best be accomplished in the context of ecosystem management and restoration and as part of planning for watersheds or river basins because many of these concerns extend across human-drawn boundaries and borders.

The Commission appreciates the complexities of these issues. As the Western Water Policy Review Advisory Commission stated in its June 1998 report, "Today, there are a number of federal, state, tribal and local agencies with competing interests and missions related to water, but none with a sufficient political or legal mandate to override the concerns of the others. This means that implementing any proposal, for almost any purpose, requires working through a complicated web of laws, regulations, and constituencies." The report cites the CALFED program in the Bay-Delta region of California as a model for resolving complex water disputes, noting that the program brought together representatives of agricultural, business, environmental, and urban concerns "to guarantee more reliable

water supplies and improved water quality for the environment, cities, and farms.”

We are encouraged by this and other examples that incorporate a broad array of environmental impacts and concerns into their processes to give interested parties a chance to reduce conflicts. We caution that in relation to drought, some preparedness and mitigation measures may in and of themselves create unacceptable impacts on the environment. For this reason, it is doubly important that environmental resource issues be included in drought preparedness efforts.

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Environmental resources often receive inadequate attention during drought emergencies and in drought planning, not so much because of lack of concern but because of lack of expertise in this arena, lack of adequate financial resources, and sometimes lack of awareness.

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### **NEED TO ADDRESS DROUGHT-RELATED WILDFIRES**

We heard that drought events often give rise to increased risk of widespread wildfires. In turn, wildfires can exacerbate the environmental impacts of drought by consuming vegetation already stressed from drought, by burning protective streamside vegetation, and in severe intensity fires by changing the composition of the soil. We heard, too, that in areas where drought occurrences are rare, people are often unprepared for wildfire. Even areas where drought is more common may lack sufficient resources for combating wildfire. Witnesses from Oklahoma and Texas told us during our hearing in Austin that they rely primarily on volunteer fire fighters to control drought-related wildfire and that they are in need of equipment and training to do a better job and help ensure the safety of the fire fighters. And in written comments, New Mexico’s state forestry division noted that accurate weather predictions are important to fire managers for safety reasons and that the Palmer Drought Index with its emphasis on soil moisture is not sufficient to give fire managers the information they need about fuel moisture.

A 1996 report of the Western Governors’ Association identified three major obstacles in suppression of drought-related wildfires:

- the financial burdens to prepare for and fight the fires,
- a lack of proper training and resources, and
- restoring forest and grassland health.

The Commission’s environmental Working Group reported that the U.S. Forest Service is authorized by the Cooperative Forestry Assistance Act of 1978 to cooperate with states in developing systems and methods for prevention, control, suppression, and prescribed use of fires in rural areas to protect human lives, agricultural crops and livestock, property and other improvements, and natural resources. The Forest Service’s Fire Sciences Laboratory has developed many tools to address fire danger and fire behavior potential at national and local levels. One tool to display broad-scale elements of fire danger is the Wildland Fire Assessment System, which is available on the internet.

Also in the environmental Working Group’s report, the Federal Emergency Management Agency emphasized that wildfire is now a part of the wildland/urban interface—no longer a phenomenon concentrated in large national forests and parks or on vast expanses of agricultural land. FEMA noted that the number of requests it received from states for assistance with wildfire increased from an average of five to seven a year during most of the 1980s to 122 in 1998. Through its ten regional offices, FEMA encourages comprehensive disaster plans and programs to increase the capability of state and local

governments in suppressing wildfires.

We learned too that the U.S. Department of Agriculture's Resource Conservation and Development Councils across the country are encouraging and assisting the installation of "dry hydrants." These relatively inexpensive structures allow fire trucks to load water from ponds on cooperating farms during emergencies.

#### **NEED FOR TRAINING AND TECHNICAL ASSISTANCE**

Planning provides opportunities for the general public to become involved and invested in drought-related decisions—for example, adopting water conservation measures year round—and to learn more about drought, leading to greater self-reliance and self-determination. It also emphasizes local solutions based on consideration of all affected entities and related issues, including legal, economic, geographic, climate, religious, and cultural differences; fairness and equity; and environmental concerns. These opportunities are lost where people are not sufficiently trained to engage in drought planning or lack adequate technical assistance to do so.

Hands-on training and technical assistance programs can help formulate and implement plans to incorporate drought planning and mitigation measures, which address human and environmental needs. Such programs can help farmers decide whether to include drought-resistant crops, on-farm wells, crop insurance, conservation systems, restoration of wetlands and wildlife habitat, and other important factors into their risk-management strategies. They can help farmers install water management practices and gain a basic understanding of the soils and climate conditions in their areas and the types of crops and plants suitable to those sometimes changing conditions. Such assistance can also help them understand complicated marketing options and other methods to manage risks.

Training and technical assistance programs can help communities as they determine their own priorities for incorporating drought concerns and the need to protect environmental resources into ongoing land-use and community planning and into comprehensive water management plans aimed at ensuring safe, adequate drinking water (urban and rural) as well as water needed to fight fires. They can help drought planners decide whether they would benefit from simulated drought-response exercises like those conducted by the Army Corps of Engineers.

We often heard that local governments know their situations related to impending drought better than anyone else. Still, they may need training and technical assistance in gathering drought-related information, devising drought impact-reduction strategies, and preparing public education and involvement campaigns to develop locally appropriate solutions. State climatologists and researchers in university drought-related programs, as well as federal experts, are potential sources for training assistance. In addition, federal and state agencies often have had experience with the types of emergencies that can occur and what measures were taken to respond to the emergencies. Examples of such measures are standard operating procedures for laying emergency pipelines, trucking water, or locating ponds across a county where fire fighters can obtain water to fight wildfires.

#### **NEED TO ADDRESS INTERNATIONAL DROUGHT-RELATED ISSUES**

Because drought is a worldwide phenomenon, the United States has the opportunity to share drought experience and expertise with other countries and to learn from them. We heard from federal agency personnel that several information-sharing projects are underway through the United Nations and other entities.

Such efforts are not limited to the federal level. The cities of San Diego, California, and Tijuana, Mexico, for example, have developed the capability to connect their water systems and transfer potable

water during times of drought or other emergencies.

In the arena of water supplies, the border between the U.S. and Canada cuts across natural drainage basins. Thus, the actions of one country can affect the other, and the impacts of drought can cross the border. Although drought is a serious issue in the Columbia and Great Lakes basins, the two countries have strong working relationships on these issues. For example, droughts can lower the levels of the Great Lakes, reducing hydropower generation, increasing shipping costs, and making the lakes less accessible to recreational boaters. The primary response is to dredge more and to extend boat ramps.

The International Boundary and Water Commission monitors the allocation of water from the Colorado and Rio Grande rivers between the United States and Mexico. Currently, Mexico owes the United States water from the Rio Grande, but has not provided it. We heard from witnesses during our hearings in El Paso and Austin that this has had negative impacts on the drought-stricken lower Rio Grande section of Texas.

## CONCLUSIONS

From its findings, the Commission drew the following conclusions.

- The United States would benefit from development of national drought policy with preparedness as its core.
- Comprehensive, proactive drought planning and mitigation measures that incorporate long-term strategies can lessen the impact of drought on individuals, communities, and the environment. They can also reduce the need for future emergency financial and other relief.
- The people and entities that are likely to receive the greatest share of federal emergency assistance because of drought—that is, farmers, livestock producers, and other rural entities—often have the fewest personnel, information, and financial resources to prepare for and mitigate the potential impacts of drought.
- Individuals, businesses, local/county/state governments, tribes, and nongovernmental organizations with an interest in or responsibilities for drought management—as well as the general public—would benefit from training and technical assistance to plan for and reduce the impacts of drought.
- There are a number of “success” stories in drought preparedness at the individual, local, state, regional, and federal levels that would make excellent models for use in training and technical assistance.
- A pooling of federal, state, and local experience, possibly in the form of a handbook on emergency planning, would be a useful tool in helping determine which measures and resources need to be in place to respond to emergencies whose particular causes are unforeseeable.
- Mitigation activities such as water conservation, reuse of wastewater, pricing strategies, and the identification of back-up water supplies—when initiated before an emergency—can reduce vulnerability to drought events.
- Partnerships among nonfederal governments, the federal government, and private interests can go far in developing the tools and strategies for formulating and carrying out appropriate drought preparedness and mitigation plans.
- The most effective drought preparedness and mitigation plans should have clearly identified objectives and performance standards and a clear exposition of the vulnerability of a region to drought, given current and expected water resources infrastructure and water uses. They will also build in flexibility to allow for social, cultural, and religious differences to avoid a “one size fits all” approach that sets rigid criteria for the plan.
- Effective plans should call for an evaluation of drought-related programs to determine whether they identify and address priority environmental impacts. As examples of priorities, terrestrial and aquatic ecosystems are exceptionally vulnerable to drought. Mitigation of the impacts on such environmental resources needs to be improved through better planning, training, incentives, technical assistance, research, and public education.
- Effective plans should consider the allocation of water to meet the need to protect the environment and to meet immediate human needs.
- Effective plans should also be designed based on cost and performance and incorporate staged responses to incipient droughts at pre-defined trigger points.
- For urban and rural communities, effective plans should include considerations such as the location of alternate or supplemental sources of water, how this water can be conveyed to the point of need, and whether additional treatment is needed.

- Drought-related data can be better marshaled, interpreted, and disseminated to all parties with an interest in drought, including the media and public at large, so that citizens and experts in drought management alike can gain the knowledge they need to help lessen the impacts of drought.
- Easy access is needed to information on nonfederal and federal programs related to drought monitoring, assessment, and prediction. Effective drought monitoring requires information on climate and water supply conditions, including information on precipitation and temperature, soil moisture, stream flow, reservoir and groundwater levels, and snow pack.
- Drought-related research is the foundation of many drought programs and is critical in the production of high-quality innovations that lead to improved drought preparedness and mitigation measures.
- Even the best preparedness measures may not sufficiently reduce many risks associated with drought nor eliminate the need for emergency relief during severe droughts.
- There is considerable sentiment among farmers, ranchers, and tribes to make the U.S. Department of Agriculture's crop insurance more responsive to their needs by extending coverage to include all crops and livestock.
- Severe urban droughts declared to be emergencies or disasters by the President are not as common as agricultural droughts. Like agricultural droughts, however, they will occur despite the best preparedness and mitigation measures to reduce vulnerability to drought. And because they are likely to affect the availability of potable water and therefore are likely to affect people directly, they demand immediate response.
- Federal drought-related programs lack a coordinated approach so that delivery of program services is less efficient, effective, and timely than it could be. The U.S. Department of Agriculture and other federal agencies involved in assisting people with drought activities need to improve their internal and external coordination practices to provide services more appropriately and expeditiously.
- Federal programs for drought preparedness assistance need to be more flexible to account for the diversity of conditions and drought-related impacts across the country.
- Some federal drought-related programs are neither authorized nor funded at the level needed to deliver effective services. Furthermore, their eligibility criteria and cost-sharing requirements may restrict participation by tribes, farmers and ranchers, and others with limited resources.

## RECOMMENDATIONS

The basic premise of the Commission's recommendations is straightforward: **We can reduce this nation's vulnerability to the impacts of drought, and thus reduce the need for emergency relief, by making preparedness the cornerstone of national drought policy.** Investments on the front end in preparedness will save money over the long run.

The goals are:

1. Incorporate planning, implementation of plans and mitigation measures, resource stewardship, environmental considerations, and public education as the key elements of effective national drought policy.
2. Forge closer ties among scientists and managers so that scientists understand which monitoring, research, data collection, modeling, and other scientific efforts are needed to reduce drought impacts and improve public understanding of those impacts.
3. Develop and advocate comprehensive risk-management strategies into drought preparedness.
4. Maintain a safety net of emergency relief that rewards stewardship of natural resources and self help.
5. Coordinate drought programs and response.

We recommend that Congress pass a National Drought Preparedness Act, which would establish a nonfederal/federal partnership through a National Drought Council as described in Recommendation 5.1. The primary function of the Council is to ensure that the goals of national drought policy are achieved.

### **1. Incorporate planning, implementation of plans and mitigation measures, resource stewardship, environmental considerations, and public education as the key elements of effective national drought policy.**

The commission strongly endorses preparedness as a key element to reduce the impacts of drought on individuals, communities, and the environment. Most levels of government and most of the private sector are not adequately prepared for drought. We believe that coordinated drought preparedness programs will lessen the need for future emergency financial and other assistance through proactive measures and long-term strategies in drought plans and as the basis for effective training and technical assistance.

- 1.1 Congress should provide incentives (technical and financial assistance) to states, localities, tribes, regional entities such as watershed and river basin organizations, and to the private sector to encourage development or revision and implementation of comprehensive drought preparedness plans. The President should direct all appropriate federal agencies to cooperate fully and to provide all assistance possible in these efforts.
  - The ultimate objective is that all water users at all levels of government and in the private sector will have a drought preparedness and public education plan in place and being implemented. Drought planning should be a continuing process and part of a more comprehensive water management program. Each drought plan should include: (1) an analysis of past, current and projected water demand, instream flow needs for appropriate ecosystem protection, water availability, and (from these) potential water shortages; (2) a description of how shortages would be met (for example, increased supply, leak detection/elimination, water use efficiency, demand management) and

an estimate of associated costs; (3) a description of interagency/ intergovernmental coordination and public participation; (4) consideration of social and economic factors and consequences; and (5) appropriate mitigation of drought impacts on the environment. Drought planning entities should be encouraged to use or adapt existing planning materials and resources such as those developed by the National Drought Mitigation Center, the Army Corps of Engineers, the U.S. Department of Agriculture, the Western Drought Coordination Council, the states, and urban and rural water districts.

- The President should direct all appropriate federal agencies to use tools such as technical assistance, training, collaborative planning, financial assistance and other incentives, technology transfer (national as well as international resources), and public education strategies to assist in development of drought plans. Use of these tools at the federal level should be based on the National Drought Council's assessments of vulnerability to drought impacts and the Council's subsequent recommendations for priority use (see Recommendation 5.1). Consideration should be given to the special needs of tribes, whose representatives indicated that even basic information for planning is not available to them, and to small rural water districts and self-supplied domestic water users who are particularly vulnerable to the impacts of drought.
  - In relation to regional drought initiatives, Congress and the President shall encourage regional drought initiatives. The National Drought Council shall facilitate the efforts of existing regional entities. In addition, the Council will facilitate, in collaboration with local and state governments, development of similar initiatives in regions that currently lack drought preparedness plans. The Council should also coordinate an assessment of major river basin initiatives to determine which methods have proven most effective in reducing conflicts over water resources.
- 1.2 Congress should adequately fund those federal agencies with current authority to offer technical and financial drought assistance to nonfederal entities, as part of existing and future programs, and to develop and implement drought management plans. Congress should authorize and adequately fund programs to address needs not met by current programs.
- 1.3 The President should direct all appropriate federal agencies to develop and implement drought management plans for federal facilities such as military bases, federal prisons, and large federal office complexes in the United States. These plans should be coordinated with local and state drought planning and mitigation measures.
- 1.4 The President should direct all appropriate federal agencies to study their programs for potential impacts on drought. Where such potential exists, the agencies need to integrate national drought policy into their programs.
- 1.5 The President should direct federal agencies having water resources management programs to develop for themselves and to assist nonfederal entities in the development of a comprehensive program to promote public awareness as part of an ongoing drought preparedness program. A public awareness program should include at least the following components:
- Public involvement before, during, and after the development of drought preparedness plans. The planning entity should seek broad community input and support for the planning effort. Participation should be actively solicited from a full spectrum of the local population—all age groups, all cultural and ethnic groups, and all economic levels.
  - Public information. The public needs to have access to understandable, informative materials on all aspects of drought. This includes an explanation of the causes of drought; impacts and damages caused

by drought; clear instructions for appropriate responses to drought (water conservation, water reuse, leak detection and elimination, etc.); and requirements of local ordinances or state law during droughts. This information should be provided in as many locations and as many formats as possible, including printed booklets or brochures, telephone hotlines, public service announcements, media events, computer web pages, and classroom presentations.

**2. Forge closer ties among scientists and managers so that scientists understand which monitoring, research, data collection, modeling, and other scientific efforts are needed to reduce drought impacts and improve public understanding of those impacts.**

The Commission supports drought monitoring/prediction, operational products, and research efforts that make the greatest contribution to improved preparedness and risk management, and, ultimately, to reduced relief payments. The National Drought Council (see Recommendation 5.1) will be responsible for coordinating national drought policy and is the logical body to recommend priorities. The Council will coordinate a formal process—such as a drought monitoring, prediction, and research “summit” of multi-disciplinary, geographically diverse representatives—to ascertain the needs and expectations of all interested parties as a first step in prioritizing recommendations. Based on the Commission’s findings and testimony at public hearings, the recommendations will focus on monitoring/prediction and operational products as well as research applications. Research should address the impacts of drought on non-irrigated systems, aquatic ecosystems, wildlife, and other aspects of the natural environment, including the potential negative impacts of drought mitigation measures. Continued participation by and better coordination of the federal government and other governmental and private entities in international drought research, education, water conservation, and technology-transfer programs is essential. The Secretary of Agriculture will include a description of the information products most needed to reduce drought impacts in an annual report to Congress and the President (see Recommendation 5.2).

*Monitoring/prediction and operational products*

- 2.1 We recommend that Congress authorize and the Administration develop and implement a plan to coordinate—in cooperation with states—and expand, modernize, and maintain a system of coordinated observation (U.S. Geological Survey streamgaging, SCAN, COOP) networks (based on the National Drought Council’s study described above) that meets the needs of all stakeholders, with priority given to filling the gaps on tribal lands and in rural America.
- 2.2 (a) We recommend that Congress authorize and the Administration establish a comprehensive information clearinghouse such as the National Drought Mitigation Center to provide users with complete access to drought monitoring, prediction, impact assessment, preparedness, and mitigation measures and to link information from federal and nonfederal sources.  
(b) We recommend that Congress authorize and the Administration implement a nationwide information delivery system—such as the United Climate Access Network (UCAN)—reflecting regional and state differences to increase access to and availability of weather, water, soil, and climate data and information.
- 2.3 We strongly support the need for improved accuracy and frequency of drought predictions that are disseminated in a timely fashion for decision makers. Accordingly, we recommend the establishment of a drought impact assessment team of federal, state,

and other experts who are responsible for analyzing the causes and aggravating factors contributing to drought and its impacts after drought events occur.

- 2.4 We recommend expansion of appropriate technology-transfer programs at the international level related to drought preparedness and water conservation.
- 2.5 We recommend completion of a national soil survey on all lands. This survey is crucial to entities such as Native tribes and individual landowners who lack basic data for drought planning.

### *Research*

- 2.6 We recommend that existing competitive research grant programs give high priority to drought to encourage opportunities for undergraduate and graduate students and on-the-job trainees to work with community, county, state, regional, and tribal planning bodies; with scientists conducting drought-related research; and with the people providing drought-related training and technical assistance.
- 2.7 We recommend that the President direct appropriate federal agencies to address the National Drought Council's recommendations for monitoring/prediction, operational products, and research when developing their programs (see introduction to this section on preceding page). Furthermore, the agencies should continue and improve successful products such as the U.S. Drought Monitor, which was developed cooperatively by the National Drought Mitigation Center, the Climate Prediction Center, and the U.S. Department of Agriculture.
- 2.8 In recognition of the products and resources of the National Drought Mitigation Center, National Science Foundation, U.S. Geological Survey, National Oceanic and Atmospheric Administration, Agricultural Research Service, U.S. Forest Service, Bureau of Reclamation, and Department of Energy, we recommend that Congress provide an adequate annual budget to support continuation and improvement of their drought related work.

## **3. Develop and advocate comprehensive risk-management strategies into drought preparedness.**

Although we firmly believe that preparedness measures will go far to reduce this country's vulnerability to drought, we also recognize that prolonged drought causes risks that the best preparedness measures may not adequately address. The most significant approach in recent years to risk management is the federal government's crop insurance program for farmers. As we heard, however, that program does not cover all crops nor does it cover livestock. In addition, payments from the program are often "too little, too late" and are administered differently across the country. There is no similar program for others who are at particular risk from drought. Assistance must be pieced together from various sources or is simply not available. Time and again, the federal government is asked to appropriate emergency relief dollars that in recent years have averaged \$7.5 billion. Emergency relief that can be attributed to drought only may approach a billion dollars a year.

We had neither the expertise nor the resources to investigate thoroughly the various options for improving the crop insurance program or the other risk-management proposals that were presented during

our deliberations and that Congress has grappled with for many years. However, we are convinced that sound risk-management strategies are essential if the country is to move away from emergency relief in response to widespread drought.

- 3.1 We recommend that Congress authorize a study to evaluate different approaches to crop insurance, including a cost of production plan, an adjusted gross revenue plan, and other proposals that warrant consideration (see earlier discussion of risk management).
  - 3.2 We recommend that the U.S. Department of Agriculture, in cooperation with state and local governments and the private sector, expand training to rural communities, farmers, and ranchers across the country on various financial risk-management strategies.
  - 3.3 We recommend that the Small Business Administration, through its private-sector partners, provide information and training to small business owners on developing financial and business risk-management strategies.
- 4. Maintain a safety net of emergency relief that rewards stewardship of natural resources and self help.**

The Commission recognizes that over time, efforts at drought preparedness and risk management can greatly reduce, but not eliminate, drought-related emergencies. Response measures for drought emergencies can also be useful to respond to water shortages not caused by drought. In all cases where emergency response is required, it should be effective and timely.

#### *Agricultural emergency response*

- 4.1 Congress should authorize the Secretary of Agriculture to borrow from the Commodity Credit Corporation to implement the Department of Agriculture's emergency programs (for example, the Emergency Conservation Program and the Emergency Watershed Program).
- 4.2 The Department of Agriculture should establish a single procedure for timely triggering all of the Department's disaster programs such as a drought designation by the Secretary.
- 4.3 In the event of a serious drought and Congress and/or the Administration determines that emergency financial assistance is warranted, we recommend that Congress and/or the President acknowledge and encourage natural resource stewardship and self help.

#### *Non-agricultural emergency response*

- 4.4 Congress should authorize a standing fund similar to that available under the Stafford Act for non-farm drought emergencies that affect tribes, communities, businesses, and the environment, but that does not duplicate Stafford Act authority.

#### *Potable and industrial water supply emergency response and planning*

- 4.5 The President should direct the appropriate federal agencies, in cooperation with the National Drought Council (see recommendation 5.1), to develop a handbook of emergency drought

preparedness measures for widespread public distribution.

- 4.6 In the event that the President declares a drought disaster or emergency pursuant to the Stafford Act, the Federal Coordinating Officer will coordinate closely with other federal agencies represented on the National Drought Council. The Federal Response Plan should be reviewed and amended, if necessary, to ensure appropriate coordination of federal resources in presidentially declared drought emergencies.

## **5. Coordinate drought programs and response.**

The federal drought program is a collection of initiatives run by different departments and agencies. Every analysis of past responses to major droughts notes that these programs need to be better coordinated and integrated. The legislation enabling the National Drought Policy Commission cited this problem and asked the Commission to recommend whether all federal drought preparation and response programs should be consolidated under one existing federal agency and, if so, to identify such agency.

We believe that such consolidation would be impractical and ineffective. Drought affects a wide array of constituents, among them farmers, ranchers, non-farm businesses, tribes, water districts, municipalities, and industry. The federal expertise required to address the needs of these constituents and the impacts of drought on the environment resides in many agencies. The federal agencies currently involved in drought programs report to multiple congressional authorizing and appropriating committees, making it difficult to restructure these authorities appropriately in a timely manner.

In arriving at its recommendations, the Commission considered the consolidation option and three others. The first was a “National Drought Council” similar in composition to the National Drought Policy Commission, but that also includes a representative from the U.S. Department of Energy, a representative from the Environmental Protection Agency, and a nonfederal, nongovernmental environmental representative. The second option was a presidentially created federal drought coordinating body comprised of only federal representatives from the appropriate federal agencies. This entity would be directed to coordinate with state and local governments, tribes, regional drought-related entities, and the private sector in carrying out its duties. The third option was to build on existing, less formal models such as the Department of Agriculture’s Resource Conservation and Development Councils or the Association of State Dam Safety Officials.

We recommend the following:

- 5.1 Congress should establish a long-term, continuing National Drought Council to coordinate federal and nonfederal interests, needs, programs, and stakeholders. In the interim, we recommend that the President immediately establish a federal agency coordinating group, chaired by the Secretary of Agriculture, to begin appropriate implementation of the recommendations of this report. Once the National Drought Council is created, the federal agency coordinating group should become part of the Council. The Council should either be exempt from FACA or constituted in a way that does not trigger FACA. Primary responsibilities of the Council include:
  - Coordinate delivery of existing and new federal drought programs and facilitate appropriate outreach to assure coordination of federal programs with other governmental and nongovernmental entities and all other interested parties.

- Encourage states, localities, and sovereign tribes to coordinate with current regional drought planning entities, perhaps within watersheds or river basins, or to establish new regional entities. Members of these planning entities would define their goals and methods of operation. For example, they may decide to establish sub-regions in recognition of specific conditions that may lead to drought in one area of the region, while another area may not experience drought. The Council's role would be to coordinate available assistance to the regions. The Council would collaborate with the governors of all states in each region, appropriate agencies, and interested parties and seek the counsel of university researchers with drought-related expertise.
  - Coordinate a periodic in-depth evaluation of federal drought-related programs to determine the degree of customer satisfaction, the extent of gaps that exist between program goals and service delivery, and other circumstances that may hinder effective operation.
  - Coordinate development of a detailed implementation plan as soon as practicable. The plan will include specific actions in each of the four program areas (preparedness, information and research, risk management, and emergency relief) and specific steps to maximize customer satisfaction.
- 5.2 We recommend that the Secretary of Agriculture chair the Council. The Secretary of Agriculture will report to Congress and the President annually on the activities and recommendations of the National Drought Council.
- 5.3 We recommend that Congress provide federal departments and agencies with appropriate authority and funding needed to support the activities of the National Drought Council and to carry out the recommendations in this report.