



# Issues and Options for Congress



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Federal support of Western water-resource management and planning is critical for that region's agricultural and economic development. Most of the West's water-resource problems are at least regional in scope and extremely difficult in nature, involving a complex web of physical, chemical, biological, economic, legal, and sociopolitical issues. Often, they go well-beyond the ability of a single Federal agency, State, university, or group of organizations to address effectively. Although Western State Governments have increased their role in this area, they cannot, by themselves, handle all the problems.

Because water does not remain within State boundaries, water-related activities in one State may have consequences beyond that State. Strong Federal involvement under the Clean Water Act continues to be needed to assure a high quality of Western waters as they pass through a river basin or an aquifer from one State to another. Federal funding and support in cost-sharing arrangements remains important for those regional water projects that require substantial investments, including those related to rehabilitating existing projects. Federal support for research in water resources and water-resources management continues to be needed to ensure that short- and long-range national interests are served. In addition, long-standing Federal obligations in reserved water rights, especially for Indian reservations, and in international agreements involve issues that

require Federal attention. Finally, carefully designed Federal incentives should still play a role in helping States and individuals explore and develop effective water management planning and equitable problem-solving of water-use conflicts.

Congress, however, cannot act alone to be effective in this complex and diffuse area. Federal, State, and local governments are all involved with the regulation of Western water for agricultural and other uses. This involvement affects and guides use and development of water-related technologies for arid/semiarid agriculture. The broad types of Federal tools available to influence research and use of these technologies include developing goals and priorities for Western water use and agriculture, providing incentives, penalizing abuses, promoting improved management, equitably resolving conflicting claims and demands, and providing more and improved information.

The following policy issues have been identified by OTA as those requiring congressional attention and action over the next few years to further the goal of sustainable agriculture in the West. They are grouped in three major categories (treating renewable resources as systems, sustaining long-term productivity, and involving users in decisionmaking) and are not listed in any order of priority,

## **TREATING RENEWABLE RESOURCES AS SYSTEMS**

This major action area is divided into three categories:

1. How Western scientists, water users, universities, and the public-at-large can play

an increased role in decisionmaking about water and Western agriculture,

2. How congressional decisionmaking can be strengthened.

3. How other Federal and State Government agencies can improve specific programs.

**Issue 1: The Need for an Interdisciplinary Program of Basic and Applied Research on Arid/Semiarid-Water Resources**

Federal attempts in the 1960's and 1970's to build broad-based national programs in water-resources research and management through the Water Resources Council and the Office of Water Research and Technology were substantially reduced in the 1980's. Awareness of growing Western water problems has increased at a time when the Federal role in coordinating water-related research across the Nation has in large part been eliminated.

Many of the Nation's universities have research programs on problems of water resources or water-resource management. Representing a wide variety of approaches and focuses depending on their funding priorities, these programs involve a range of the natural and social sciences and engineering. Frequently, agricultural departments within the land-grant schools utilize cooperative USDA-State experiment station arrangements. Other universities outside the land-grant system or other nonagricultural departments in land-grant schools may conduct their work without cooperative USDA arrangements.

University programs related to water resources include biological and geochemical research on water quality; studies of ground water hydrogeology, recharge, and contamination; studies of wastewater treatment and reuse; studies of weather modification; research on interbasin transfer and on more efficient use of water in agriculture; and studies of the economic and legal aspects of water-resources management. These efforts include laboratory and field research as well as theoretical studies. They entail use of any array of field-measurement devices, computer modeling, or analytical instrumentation, or a combination of the three. They are housed in many different departments, colleges, and institutes of the universities, often appropriately in a

number of sites on a single campus, depending on the focus and approach being pursued. All such programs have at least one feature in common; they are all directed toward developing new insight into the region's and Nation's water supply.

However, the present situation lacks national coherence. No mechanism exists for coordinating water-related basic and applied research as it might apply to the wide range of water-resources problems in the U.S. arid/semiarid lands. Often, links are not made to the broader national or regional public policy relevance of individual university research efforts.

A mechanism is needed that will focus the multiplicity of university water-related research approaches and disciplines on Western and national water problems. progress in Western water-resources research, both basic and applied, will benefit substantially by the creation of a mechanism to focus and coordinate the talents of the Nation's universities, the research experiments of the innovative farmer and rancher, and the resources of the private sector.

**Option: Establish a National Center for Water Resources Research**

Congress could establish a National Center for Water Resources Research to provide a coherent and coordinated mechanism for the Nation's university research programs in water-resources management for problem-solving and policymaking. The mission of this center could include:

1. Undertaking an interdisciplinary program of basic and applied research on water resources and water-resource management. In addition to research in the natural sciences and engineering, the program should include a strong component of basic and applied research in the social sciences, such as resource economics and law as they pertain to water-resources programs. The center could further assist in

the conduct of site-specific research being carried out under State auspices.

2. Developing and providing advanced and sophisticated research facilities on a scale required to cope with the broad nature of water-resources problems, and often not affordable by single universities, to be used both by the resident staff, innovative producers, and university scientists.
3. Undertaking a program to develop and test conventional and emerging technologies for application to water-resources problems in U.S. arid/semiarid lands, including application to problems of agriculture and its sustainability in arid/semiarid lands, and coordinating work with existing Government research by USDA and State agricultural experiment stations.
4. Serving as an objective, nonpartisan, and continuing national source of information for Congress when formulating public policy dealing with water resources, and as a link to public agencies and to the private sector for application of research findings.

The center could serve as a base for marshaling the talents of the Nation's universities and for augmenting, but not in any sense competing with, the work already underway in the universities. Its principal function could be to enhance the effectiveness of water-resources research and to focus the full competence of the scientific community, private sector, and innovative producer on problems of water resources.

Using the example of the National Center for Atmospheric Research (NCAR), an institution created some 20 years ago by an act of Congress, the center could be managed and operated by a consortium of universities with doctoral-level programs in water resources. The member universities could elect a board of trustees from member universities, industry, user groups, and the community at large. The board could be responsible for establishing broad policy guidelines, for setting program priorities and directions, and for overseeing the center's effective management. The operation of the center could be directed by a scientist

appointed by and accountable to the board of trustees,

Because a sustained effort is essential for solving crucial water problems of the West and the Nation, the funding support for the center must be stable and long term. The principal source of support for the center could be the Federal Government, with supplemental support from the States and private sector,

An equally essential aspect for effective operation is that prime responsibility for program initiatives reside with the consortium of universities managing the center. This requirement is in sharp contrast with "Government-owned, contractor-operated" laboratories where program initiatives often reside in the sponsoring, mission-oriented Federal agency. This contrasting approach for the center is important since the university community is closest to research for purposes of evaluating progress and potentials. In light of this knowledge, plans and priorities designed by the consortium could take into account national, regional, and State needs. Congressional and State agency staff could be assigned periodically to the center to translate research results for policy-making and update researchers on ongoing policy debates and issues.

For purposes of administration and funding, the center could be operated by the university consortium under a prime contract arrangement with a semiautonomous scientific agency such as the National Science Foundation (NSF). Support from other Government agencies interested in water resources could be arranged through the single contract administered by the designated agency. The style of research program management proposed above is consistent with the research-overview style and experience of NSF.

## **Issue 2: The Need for Congress to Have Reliable Ongoing Information About the State of the Nation's Renewable Natural Resources**

OTA found that existing data available for congressional decisionmaking is scattered

throughout the Federal Government in a variety of forms. These data were not collected with the intention that each piece would be part of an integrated and self-consistent base for Congress to use in making decisions affecting resource sustainability. Moreover, existing data on components of the resource base on which agriculture depends are seldom synthesized because the data may be in noncompatible forms and no single agency has had the ongoing responsibility to seek compatibility or synthesis.

Congress needs improved information for setting near- and long-term goals for sustainable use of Western water and agricultural lands. This information should focus on congressional needs and emphasize systems analysis of data about renewable natural resources.

A recent Federal study about the analytical capability of existing executive agencies to provide this long-term resource systems planning capacity concluded:

... [E]ach agency has its own idiosyncratic way of projecting the future, based on its own responsibilities and interests. These different approaches were never designed to be used as part of an integrated, self-consistent system like the "government's global model." They were designed by different people, at different times, using different perspectives and methodologies, to meet different needs. While many are widely recognized as making outstanding use of state-of-the-art analytic procedures appropriate to their respective sectors, they produce projections that are mutually inconsistent in important ways. \*

Ongoing analysis and synthesis of existing data bases could provide improved information on the dynamics of the resource system and how interactions (natural and manipulated) among resource components affect the sustainability of Western agriculture. Congress needs improved information to understand:

1. the extent and quality of each resource component,

2. the amount and location of each resource being used,
3. how quickly and where each resource is replenished, and
4. how and what interactions among the components affect the sustainability of the system.

#### **Option 1: Develop a special analytical unit within the legislative branch**

Congress could develop a bipartisan unit within the legislative branch with the principal purpose to provide Congress with ongoing, quantitative evaluations of the state of the renewable natural resource system as a consequence of near- and long-term congressional policies. The unit's program should be interdisciplinary and multidisciplinary, with access to state-of-the-art computer facilities to conduct comprehensive data analysis and synthesis from existing data sources on specific topics requested by Congress. Such a unit could identify data gaps that are important to U.S. decisionmaking and that affect the sustainability of the renewable resource base. It would require the independence and flexibility to obtain and interpret data in a nonbiased fashion for the entire Congress. The following characteristics are important for this unit to function successfully:

1. objectivity;
2. bipartisanship;
3. ongoing capacity;
4. multidisciplinary and interdisciplinary focus;
5. access to existing public data sources;
6. best available technology to analyze and synthesize existing data quickly;
7. highly skilled specialists; and
8. a small, manageable size.

Specific organizational structure and legislative authority would have to be developed to meet the unit's defined purposes. The first step in considering this option might be a workshop of interested and involved congressional, executive, State, and local participants to examine existing problems, the history of other experience in data synthesis, and possibilities for

\* *The Global 2000 Report to the President*, Technical Report, vol. 2, 1980, p. 454; report was prepared by the Council on Environmental Quality and the Department of State.

action. This workshop might be combined with the formation of a joint committee of members from relevant House and Senate committees to plan how to pursue and consider this option further.

This option will require ongoing communications among the many branches of Government to achieve an acceptable arrangement for the new unit. Some individuals within Congress and the executive agencies may question the value of such a unit for a number of reasons. In recent years, public concern has increased over the growing size of congressional staffs. This unit, though small, could be so criticized. Others may claim that existing agencies are competent and qualified to provide Congress with the resource systems analytical capability and that a small legislative unit will require new funding at a time when funds are in short supply.

#### **Option 2: Establish an analytical unit within the executive branch**

Congress could develop an executive branch unit as an alternative to that described in option 1 to provide ongoing quantitative evaluations for congressional decisionmaking affecting resource sustainability. On congressional request, this unit could coordinate, integrate, and interpret existing information—similar to that proposed under option 1 for the legislative unit—and report directly to Congress. Traditionally, Congress has turned to the executive branch for answers to fundamental questions involved with its policymaking. Existing executive branch agencies have personnel, equipment, and many data bases. Some career staff have experience in aspects of water- and agricultural-data collection and analyses. At least partial funding might be made available in the executive branch through redirection of existing funds from lower priority activities, as determined by Congress.

possible disadvantages of this option relate to the ability of existing agencies to incorporate this function and to the nature of executive branch programs in general, as noted in the initial discussion of this issue. In recent years

Congress has found it necessary to develop in-house expertise to supplement executive branch input in areas requiring integration of issues or verification and clarification of executive agency reports. Existing executive agencies lack the analytical capacity for long-term resource systems planning. The placement of this particular unit in the executive branch poses concerns about continuity. Programs and priorities in the executive branch change with administrations. A small new executive unit is unlikely to be in a secure position to provide objectivity, coherence, and continuity, essential requirements for an effective analytical unit. The current reduction in Federal support in water-resources planning and research at a time when Western States are facing increased problems is only one example.

Currently, no existing executive agency has the broad-based coverage of agriculture and water required to meet the needs of this option. Existing executive agencies commonly must compete with one another for budget and program approval, especially where responsibilities are overlapping, as in the renewable resource areas. Any executive agency given the task of providing ongoing quantitative evaluations for Congress about renewable resources will require strong powers to obtain prompt and ongoing cooperation from each agency with potentially relevant data and expertise.

#### **Issue 3: The Need to Integrate Water-Related Agricultural Activities in Government Agencies**

The complex interrelated Western agricultural and resource problems of today require an integrated approach to program research and implementation. Generally, however, the public sector agricultural and water-related community is poorly prepared for the demands currently being placed on it in arid/semiarid agriculture.

Over the past few years, Federal reduction in effort to integrate national water matters has left the Nation with mission-oriented agencies focused on their own particular responsibilities. Present Federal agencies in Western water

and agricultural-related activities have isolated mandates and short-term remedies to parts of the problem instead of pursuing research, data analyses, and technological development with a long-term view of the growing interdependency of all processes. For example, the U.S. Geological Survey (USGS) has data on water supply and quality, but not always in a form available and useful for the more refined agricultural planning increasingly required in water-short Western regions. The U.S. Department of Agriculture (USDA) may conduct research on a particular water-related technology without linking the design and results to other important components of the onfarm process; e.g., plant drought and stress factors, soil-water management, or practices to reduce nonpoint source agricultural pollution. The Bureau of Reclamation storage and delivery projects may work from an engineering perspective but may not be responsive to the growing needs of contemporary farmers for more flexible and rapid adjustments to their water deliveries in order to “save” water onfarm. The National Weather Service may provide water-related forecasts in the West, but not in a context useful to the farmer who is planning crop-water requirements.

No longer can Western water-related agricultural problems be trusted to trial-and-error or one-problem/one-solution procedures that have been chiefly relied on in the past. Federal agencies charged with implementing congressional policies and programs need an integrated coherent approach that minimizes confusion in organizational responsibilities, and identifies technological impacts as they affect various components and ultimately the agricultural system and long-term productivity of the region. The following options are specific areas conducive to immediate congressional action, and all four are compatible with one another,

#### Option 1: Develop a USDA office of resource coordination

Congress, through the hearing process, could initiate discussions with USDA for the purpose of designing and establishing a high-level office to integrate and provide coherence to wa-

ter-related and agricultural activities within the Department. This office of resource coordination should be placed at an appropriately high level, for example, in the Office of the Secretary of Agriculture, to ensure coordination and integration of activities among all specialized agencies of the Department. The purpose of this office would be to:

1. analyze the various agency goals, priorities, and funding for any overlapping or potentially conflicting activities related to sustainable agriculture;
2. integrate the resource work of the various agencies within USDA;
3. facilitate information exchange among agencies;
4. work to develop consistency and reliability among resource data bases of the various agencies;
5. advise the Secretary on program adjustments to ensure that the Department operates with an integrated-systems approach to agricultural research, technology development, and production; and
6. oversee the development and implementation of a systems perspective to specific agency programs, such as that currently in the planning stages within USDA's Agricultural Research Service.

The office could ensure that all departmental activities involving renewable natural resources are coordinated, alleviating the situation in which programs of one agency may work at partial cross-purposes with those of another. An office located in the Secretary's Office could emphasize the critical nature of agriculture's natural resource base and make visible the role of the Department in protecting it. It could encourage the Department to take advantage of the most modern systems-analysis technology, technology that has not often been used in agriculture.

Potential disadvantages exist with this option. An office of resource coordination within USDA might become isolated from the operational activities of the Department unless careful procedures tie it to the action agencies. Its role might vary widely among administrations, making important responsibilities susceptible

to political ideology. Some agencies might view its activities as competitive with their own and not be fully cooperative.

### **Option 2: Strengthen water focus of Federal land-management agencies**

Congress could instruct the Federal land-management agencies responsible for Western public lands to strengthen their focus on water resources and water-resources management as it affects agriculture, the primary Western water user, pursuant to their multiple-use responsibilities. As part of this effort, increased program attention could be paid to the mountain snowpack areas of the West, sources of significant surface water production for the entire region.

The multiple-use concept is already embodied in a number of Federal laws, including the Multiple-Use, Sustained-Yield Act of 1960 and the Federal Land Policy and Management Act of 1976. Existing multiple-use statutory guidelines prohibit optimization of single, measurable resources (e. g., timber and cows) at the expense of less quantifiable uses (e.g., watershed and recreation), and they forbid practices that impair continuing land productivity. In recent years, however, this mandate has often been dismissed in preference for more single-purpose mandates aimed at revenue-producing activity. For the U.S. Forest Service, this focus is principally timber production; for the Bureau of Land Management, grazing. Decisions related to these single-purpose goals have left inadequate resources for the kinds of research required to adequately take into account such primary values as water in their resource-management activities.

It is important that Congress take an increased interest in overseeing implementation of the broad, multiple-use mandates of these agencies. This option will entail a reorganization of agency priorities such that more emphasis is provided for long-term benefits from water management and less emphasis is pro-

vided for short-term revenue-producing benefits from grazing and timber production. To ensure that water-management issues are adequately addressed, such tools as water impact statements might be considered. Existing legislation might be strengthened, new legislation might be added, or oversight might be more earnestly focused on this increasingly important aspect of Federal public lands management—where possible, linking budget provisions to satisfactory performance.

An increase of focus on water resources by Federal land-management agencies could lead to a significant improvement in management of water use on arid/semiarid lands. The primary water-producing areas in the West, the mountain highlands, are on public lands. As competition for available supplies increases, Federal land-management agencies could play an important role in designing and implementing long-term water-management programs for the most effective use of water and in improving the knowledge of highland-lowland water interactions for arid/semiarid agriculture.

There are several difficulties in strengthening the focus on public land water resources. Federal agencies charged with this responsibility have no standards or defined priorities for planning and integrating water projects within multiple-use objectives. Multiple-use requires tradeoffs. Some uses cannot be maximized in a multiple-use system. A greater focus on water may require adjustments in management plans that result in some revenue reduction, from timber and grazing activities, for example. Moreover, a high proportion of agency personnel may lack the training and data needed in hydrology to make the complex planning and program decisions required to effectively integrate water into multiple-use programs. Finally, political influence and economic conditions have tended to set priorities favoring timber and grazing, in spite of the multiple-use mandates. Education of Federal administrators and new thinking are required for the Federal Government to appreciate the value of water in the long-range planning of public lands for arid/semiarid agriculture.

### **Option 3: Help States integrate water-resources data bases for systems planning**

Congress could provide technical assistance and financial support to States for development of computerized water-resources data bases. A wide range of hydrologic data is presently being collected by various State agencies and private industries as part of resource-monitoring programs (e. g., of mining sites). A computerized data bank would make it possible for each State to store, retrieve, analyze, and integrate a range of data not now being entered into Federal data-storage systems, but increasingly needed for the depth of water planning required at the regional, State, and local levels for agricultural and nonagricultural purposes.

Such data bases could be designed to ensure integration of water quality and quantity data for water-resources planning. Federal funds to States for water-resources planning and coordination could be allocated for State participation in this data system. The private sector could share data and give advice on the best available technology for data storage, retrieval, and processing. Different States may need different levels of Federal technical support and financial assistance to develop basic facilities.

Difficulties in data availability and use may continue, even with the development of State data banks, without some shift in other related activities. For example, today in many Western States water-quality and water-supply responsibilities are assigned to different entities. To be effective, the development and ongoing use of data banks at the State level may require increased coordination and cooperation among the various State water-related agencies and increase in staff skilled in computer data storage and retrieval.

### **Option 4: Expand mandates of Federal agencies in instream flow matters**

Congress could expand the mandates of the Federal agencies responsible for water-project development and maintenance to take into account needs of instream flow, an area that has

had inadequate and, in recent years, reduced attention at the Federal level. The agencies could be directed to develop information and operational procedures to identify and address instream flow responsibilities and to be receptive to public concerns about instream flow issues. Coordination and consultation with other Federal and State agencies on instream flow matters could be systematized and intensified. Instructive scientific and lay publications on Western instream flow fluctuations and associated requirements to maintain the multiple purposes of each river system in the West could be an important aspect of these agencies' expanded responsibilities for instream flow matters.

The maintenance of instream flows may make it possible to maintain acceptable water-quality levels in some Western rivers without the need for greatly increased water-treatment facilities. An improved understanding of instream needs for the multiple purposes of Western river systems may also help improve management techniques to meet long-term requirements of hydroelectric generation and of fish and wildlife habitat protection. Without maintenance of some level of instream flow, the quality of the river, in effect, becomes the quality of return flows, which can often render a river unsuitable for subsequent uses without expensive treatment.

An increased Federal focus on the maintenance of instream flow requirements also raises difficult issues. Traditionally the Federal Government has deferred to the States on matters involving local water rights. In many U.S. Western river systems, virtually the entire river flow is already committed to various local off-stream uses. If instream flow requirements are to be met on these rivers, some existing off-stream uses might have to be curtailed or discontinued altogether in some of the most severely water-short areas. Over the long term, adjustments may prove the best approach hydrologically and economically. Over the near term, however, socioeconomic impacts may occur during a period of transition that may require special Federal assistance and atten-

tion to ensure that severe dislocations are minimized. Federal involvement will raise all the difficulties inherent in trying to coordinate and respect the two governmental systems con-

cerned, the long-standing States' interests in local water rights and the broader geographic and national interests of the Federal Government.

## SUSTAINING LONG-TERM PRODUCTIVITY

### **Issue : The Need for a Strong Federal Role in Water Quality for Sustainable Western Agriculture**

water-quality issues require broad geographic perspective and strong involvement by the Federal Government at a time when debate increases about the need to reduce Federal efforts in general. A strong national interest in water quality is fundamental to protecting the public health and environment in the arid/semiarid West. The Western region, with roughly one-third the volume of flow-through water as that in the East, cannot absorb the levels of industrial, municipal, and agricultural pollution that the East can. Because agriculture affects and is affected by water-quality degradation, the long-term economic development of Western agriculture will hinge on a strong national commitment to maintain high-quality standards, support pollution controls, and strengthen research efforts on the impacts of water pollution on agricultural and nonagricultural users. A concerted, focused program of water-quality maintenance and pollution control that involves the States is necessary.

The following options are compatible, and all could be adopted by Congress,

#### **Option 1: Make a firm commitment to strong Federal water-quality standards**

Congress could maintain a firm commitment, particularly under the Clean Water Act, to stringent national water-quality standards for all uses. National standards are fundamental for long-term economic, environmental, and public health protection of the Western States. Stringent national water-quality standards must be of high priority in order to protect the range of present and future interests in water,

some of which require the highest standards (e.g., for drinking water). Existing requirements should be retained, and any new or revised water-quality standards should be made to enhance rather than degrade existing water quality.

The West must be especially protective of its water quality in view of the intensity of use and reuse throughout the region and of the gaps in knowledge about the complex interaction of surface and ground water systems. Congress could take special measures to minimize the opportunity for exemptions or waivers to high-quality water standards in the West. Even one waiver could result in contamination of a river basin or aquifer to such a degree that regional and national interests could be jeopardized.

Without the maintenance of high national standards, it is conceivable that agricultural production in some areas may decrease or cease because of water-quality degradation. This situation could have major local and national implications, depending on the severity of the problem, for local economics, national food production, and international trade. If water-quality standard-setting were delegated to the States, some upstream States might lower standards, causing downstream users the increased economic burden of absorbing higher treatment costs before the water could be used. National standards are needed to ensure that economic burdens and benefits are evenly shared among States and to avoid industrial "shopping" for areas where water-quality standards are lowest.

This option requires substantial commitment of Federal, State, and local staff and finances, all of which are becoming increasingly limited. Monitoring and enforcement costs are involved as is increased research on the wide

range of contaminants likely to be present from time to time in Western water supplies.

#### Option 2: Implement nonpoint source agricultural pollution controls

Progress toward implementing nonpoint source agricultural pollution control programs is essential for the same reasons strong water-quality controls are generally needed in the West—the more concentrated contamination possibilities with any pollutant. Congress could revive national nonpoint source policy under the Clean Water Act and particularly section 208, and actively support the accelerated implementation of controls on water pollution from nonpoint agricultural sources where problems are arising. This could include documenting and monitoring attempts and successes in controlling nonpoint source agricultural pollution. Current knowledge has identified some control measures useful for nonpoint source pollution through the adoption of improved onfarm management practices. While more research will improve such understanding for even better control, current opportunities exist to reduce such pollution. Some of these practices may involve costs that are difficult for economically disadvantaged farmers and ranchers to absorb over the near term. However, such costs may be far outweighed by long-term social benefits in reduced water-treatment costs and public health problems and thus justify a Government role.

Because of limited resources, many States now rely on voluntary action and cooperation to achieve nonpoint pollution reduction. As part of its commitment to control nonpoint source pollution, Congress could direct that Federal support to State and local efforts be strengthened. Increased Federal support could come in a number of forms, including technical and financial assistance for training farmers and ranchers to implement control measures, providing incentives, and assisting economically depressed farmers to implement better practices. Federal grants to farmers might be made contingent on farmers implementing known procedures and methods, including “best management practices,” to reduce such non-

point source pollution. Federal agencies already involved at the local level could increase efforts to monitor agricultural runoff and assess methods of reducing nonpoint source agricultural pollution,

The disadvantages of this option relate principally to implementation uncertainties and costs. To ensure adoption of “best management practices,” some economically disadvantaged farmers may need technical and financial assistance to prevent the added costs from forcing them out of business. Additional resources, including staff and funds, may be required to implement the program and to enforce it through surveillance and monitoring. Furthermore, to improve understanding and control of nonpoint agricultural pollution, continued research and analyses are needed on the hydrologic impacts of agricultural practices and on improved methods of pollution control.

#### Option 3: Increase research and monitoring of agricultural and health effects of contaminants in water

Congress could increase its support of research and monitoring on the short- and long-term agricultural and public health effects of various contaminants in surface and ground water, an area of research that is presently fragmented and has few regional syntheses of data. Present understanding of water-quality conditions in the Western United States is based largely on contaminant-specific local studies. Little research, including that on ground water contamination, has been undertaken on a comprehensive areawide basis or on related health and environmental impacts. Such research and monitoring could provide valuable information for national policymaking to protect ground waters and surface waters from contamination. Existing standards may not adequately protect the public in some areas, while others may be too stringent. Once contaminants and their long-term environmental and health effects are better understood, water-quality standards can be adjusted accordingly. In view of the West's low or sporadic water-volume flows, the prudent approach is to maintain high or stringent standards for both

surface and ground waters and to support high levels of water-quality research to ensure long-term protection of public health and safety and of the environment on which agriculture depends.

This option will require the support and assistance of all levels of government. Much of the current information on specific contaminants and water-quality problems is with local and State environmental protection agencies, health departments, and universities. National synthesis and analyses of existing data and a strong national program of research will take the time and talents of health and environmental specialists throughout the country. It may be important to assist such efforts with funds and support facilities through such means as special grants administered by Federal agencies responsible for environmental or health-related matters. Duplication of effort may also be a problem unless a national focal point for coordination and information exchange can be designated and supplied with the necessary resources to function effectively.

## **Issue 2: Protecting and Maintaining the Long-Term productivity of Rain-Fed Agricultural Resources**

Protecting the renewable resource base for productive rain-fed agriculture in the arid/semiarid West is a growing concern. Western dryland and rangeland areas of the Great Plains, the intermountain States, and the Southwest are important for rain-fed agricultural purposes. Dryland farming sites represent unique, global, soil/climate resources especially suited for grain production. These areas are vast; three times as much land is devoted to dryland crop production in the West as to irrigated agriculture. Regional variations in climate exist, but dryland areas share two features: 1) a limited and highly erratic supply of water, and 2) a susceptibility to erosion. Sustainable agriculture in these areas must take both into account.

Similarly, rangelands represent a substantial Western land area and must be carefully managed to maintain productivity. The prob-

lem of cultivating rangelands has become particularly critical in the semiarid lands of the 10 Great Plains States, where vast acreages of grassland still exist, and in other States in the West (e.g., California and Arizona), where the land is particularly vulnerable to erosion. Such areas are generally unsuited for cultivation because they are either too arid or on soils too shallow or infertile to raise crops. Most rangelands are now in that category; they are unsuitable for cultivation but can produce, in an uncultivated state, forage for livestock and other important services, such as habitat for wildlife. Some Government programs currently carry incentives that encourage cultivation of arid/semiarid lands unsuited for cultivation but agriculturally valuable as rangelands in their natural state.

Maintaining and improving suitable rain-fed agricultural systems could increase resource productivity on vast amounts of U.S. land. Dryland and rangeland agricultural systems will likely increase in importance in view of uncertain water supplies for irrigation.

Since the following two options are compatible, both could be adopted by Congress.

### **Option 1: Withdraw Federal incentives for cultivation of Western lands unsuited for cultivation**

Congress could withdraw Federal incentives that induce conversion of rangeland to cropland use where that use is not suitable for the resource. One method of achieving this could be to require that applicants for Federal agricultural assistance certify that their land is not new cropland or, if so, demonstrate that a conservation plan approved by the local conservation district is in or will be in place for the land put in production. The land-capability classes could be used as a guide for determining what lands are unsuited for cultivation and, thus, ineligible for Federal assistance unless approved conservation measures ensure that the land is not degraded.

Withdrawal of Federal incentives (e.g., price supports, commodity loans, and disaster pay-

ments) for those producers who convert marginal lands to cropland would have little impact on conversion during periods of high-commodity prices since less Federal assistance would be requested. Furthermore, withdrawal would not “undo” the resource degradation that has already occurred or may occur as a result of inappropriate practices on such lands. The option does not include provision for land rehabilitation; thus, a speculator would not be given the incentive to plow-up marginal lands with the expectation that assistance will be available for rehabilitation in the event of severe erosion.

Concern may exist about the feasibility of implementing this option. Implementation problems could include the difficulty of developing adequate conservation plans for those who wish to convert rangeland to cropland. Additional staff and data may be required not only to design adequate plans, but also to enforce the plans and monitor compliance. Some sites may not have had resource surveys; thus, information may be lacking on soil resources or other related water- and environmental-data needs that are important for making judgments about the feasibility of cultivation. Finally, even though the land-capability classification system may be the best tool generally available, it has many inadequacies, and questions exist about its reliability for assessing land-conversion issues. The National Association of Soil Conservation Districts, that has tried to address some of these practical issues regarding implementation, maintains that the attempt is still worth trying in view of the growing severity of the conversion problem.

### **Option 2: Direct increased attention to rain-fed agricultural technology research and development**

Congress could direct USDA to increase its research and development focus on rain-fed agricultural systems—both rangeland and dry land. As Western water restrictions and costs grow, irrigated production of grains and other crops may decrease over time in many western areas that can produce rain-fed crops. These areas may be well suited to production of stress-resistant varieties of conventional crops

and of other crops that are not now domesticated or widely grown. Significant opportunities exist to develop and expand dryland and rangeland research into these broader areas of focus. Moreover, many dryland and rangeland areas could produce beyond their current capacities if a broader focus and strengthened support were given to some of the long-term opportunities of such technologies as water-conservation practices, land reclamation, integrated brush management, sophisticated range management, and other biological techniques that are based on the strengths of the natural systems.

One means of implementing this option could be to convert some existing USDA field stations specifically to facilities to test and develop technologies. Such research and development could be part of an integrated resource approach to sustain or improve long-term productivity of rain-fed agriculture in U.S. arid/semiarid lands. Congress could hold hearings with USDA to examine USDA's existing stations for the purpose of identifying those facilities most appropriate for conversion. Research results could be made readily available to ranchers and farmers through cooperation with other USDA laboratories, State experiment stations, extension services, pilot projects, field-demonstration days, and exhibits for the public. Grants might be provided to individual producers to test new technologies. Cost-sharing arrangements could increase emphasis on innovative technologies.

Some may argue against this option, urging that more and better crops for rain-fed agriculture may not be needed. However, that claim is valid only if large quantities of “new” water become available to agriculture, an unlikely possibility in the foreseeable future according to the findings of this assessment. Others may argue that rangeland research will be unnecessary because red-meat consumption may decline requiring less forage for livestock. Finally, resources devoted to potential new crops adapted to low-water regions could decrease those available for growing current commodity crops.

## INVOLVING USES IN DECISIONMAKING

### **Issue 1: Achieving Equity in Western Water Availability and Distribution**

Lasting settlement of conflicts over water use in the arid/semiarid West must involve principles of equity and fairness. The Federal Government, acting as public trustee for Federal reserved water rights, is directly involved in water-equity issues in the Western United States. Without the application of equity principles in water distribution and development, perceptions of unfairness will exist, and conflict and litigation, already problems of serious proportions, will increase.

Water is security as well as opportunity in the West. Because of water's special properties as a dynamic renewable natural resource and a fundamental social good, it has always been subject to some public regulation to protect public interests. The practical application of equity principles to protect the social value of water has become a difficult test for contemporary institutions as rising demands have increased pressure on dwindling supplies. In light of growing conflicts over use, the need for Western institutions to ensure equity and fairness in decisionmaking on water distribution and reallocation is a growing concern for many users. It is especially worrisome for those rightholders who may not have developed their rights and for third parties who may be harmed by shifts in resource use or by resource degradation.

#### **Option: Assume leadership role in directly addressing issues regarding Federal reserved water rights**

Congress, in its leadership role under the Federal reserved rights doctrine, could increase its efforts to address the complex and long-term task of resolving issues surrounding Indian reserved water rights and how they can be protected in the future in view of increased competition over water. In particular, two initial actions are appropriate. First, increased op-

portunity could be provided for negotiation and ongoing representation of Indian interests in both Houses of Congress. This might be accomplished through a variety of approaches, including the initial appointment of a joint House and Senate committee or a special task force to better define specific options for Congress, or the creation of a subcommittee on Indian affairs. Second, to protect reserved rights where States have already fully appropriated water, legislation could establish a mechanism to remunerate or compensate reserved rightholders for water being used by others and to provide for eventual reallocation of water to reserved rightholders.

Because Congress has consistently left these issues unresolved, piecemeal court decisions have increased uncertainty for all parties, and important Federal interests and economic investments have been threatened. In recent years, pressures have grown (due to both non-Indian and Indian needs) to quantify present and even future rights. Under the Federal doctrine of reserved water rights, Indians were promised use of adequate supplies of water to meet present needs and future opportunities. By the very nature of the rights, society has agreed to live with some uncertainty in order to protect Indian homelands, so long as the claims are reasonable. The Federal Government, as public trustee, has an obligation to fulfill these agreements and promises. Congress could act to ensure that the Federal Government adequately protects Indian interests by resolving issues surrounding reserved water rights through the types of actions mentioned above. This will be an important step in the effective long-term planning and development of sustainable Western agriculture,

#### **Option 2: Establish a congressional committee to oversee the renewable natural resource interests of disadvantaged populations**

Congress could establish a Select Committee on Disadvantaged People and Renewable

Resources to investigate and recommend legislation to protect the natural resource interests of disadvantaged populations. A particular focus for Western disadvantaged people, especially poor farmers and Indians, could be their relation to water resources. Among the topics the committee could address is a mechanism to educate these groups about their stake in water management.

In addition, the committee could investigate the possibility of legislation to help disadvantaged Western people form mechanisms to bargain collectively for Western water rights that might be bought or sold in a market framework. This kind of modification to “free” market economics with respect to public properties of water could help ensure that equity interests are represented in large water-market transactions. For example, large energy companies might choose to buy up major water rights. This shift in water use could result in major changes in economic patterns and in community life, along with severe dislocations for many of the residents, including remaining farmers. These changes may not be agreeable to some community members. Where such shifts are likely to precipitate community change with major lifestyle implications, equity principles would suggest everyone needs the opportunity to participate in decisions about how the water is to be used. The opportunity to participate fully and fairly requires that information be made available on ways to pursue lifestyles in spite of change as well as ways to participate in the transaction generating the change.

Congressional action on this option and the related prior option on Federal reserved rights will be a challenge politically and administratively. Competent, sensitive staff, flexible and creative negotiation, and a visibly strong national commitment will be required for a long-term effort if these complex areas are to be addressed effectively. Already, perceptions are growing among poorer farmers and American Indians that existing Western and Federal institutions responsible for water distribution and development have not always treated them fairly. Committed congressional action is

needed on both options to overcome conflict and litigation, all of which will severely hinder secure water-resources planning and management for sustainable Western agriculture,

## **Issue 2: Understanding the Impacts of Water Pricing on the Adoption of Technology**

Farmers and ranchers respond to economic conditions in their attempts to become efficient. Federal subsidies have lowered the cost of water for many Western users. When water is inexpensive, the use of large amounts of water may be efficient from the user’s point of view but not from society’s point of view, since society (the subsidizer) is paying for some of the individual’s costs. Although farmers and ranchers have adopted more efficient technologies in recent years, they have done so generally for reasons other than water conservation, usually to reduce energy or labor costs. Water conservation, when it has occurred, has been a secondary benefit in most areas.

Existing Federal water-project repayment laws and policies are receiving increased attention and study. Reforms being proposed in both the legislative and executive branches include more equitable cost-sharing arrangements and greater cost recovery from the water users. Such reforms will have the effect of helping move the cost of water to a level more reflective of its scarcity value.

As the cost of water increases, some agricultural users may find it economically profitable to transfer (sell or rent) their water rights, especially those senior rights that may attract a high market value. Other agricultural users may adopt more efficient water-use practices to reduce total input costs, in view of higher water prices, and remain a profitable operation. The price of water in a water market may be affected by Federal action with water subsidies insofar as those subsidies affect the quantity of available water.

The short- and long-term consequences of greater market activity in Western water are matters of lively debate and growing concern, especially for some Western farmers. Water is

a resource with physical characteristics and social value not suited to a pure market situation. Transfers of major upstream water rights could conceivably have hydrologic and economic consequences downstream. Moreover, questions exist about the desirability from a national standpoint of allowing water markets to develop without some measures to assure that existing agricultural users are not severely harmed and that long-term public welfare is benefited.

**Option: Evaluate the impacts of water markets on agriculture and related economies**

Congress could seek the assistance of the Congressional Budget Office (CBO) in a study of the short- and long-term economic impacts of reduced water subsidies and increased water-market activity on Western agricultural users and nonfarm economies. A CBO analysis can help Congress: 1) understand the possible near- and long-term economic consequences of reforming water-project repayment plans and programs for Western agriculture and nonfarm economies; and 2) provide guidance, monitoring, and assistance with the transition to greater use of water markets to the extent that is likely to result from reduced development subsidies. Although scattered studies are beginning to appear on the economics of water in the West, CBO could provide an objective, comprehensive synthesis of available socio-economic information and a focused analysis of the Federal connection with the economics of Western water and agricultural practices.

Over the near term, an easier solution might be to allow the existing situation to continue. Gradually, however, water-related problems aggravated by competing demands will probably increase. Actions such as this option may help Congress deal with the changes likely to occur because of water-subsidy reform, particularly those changes in Western agriculture and in nonfarm economies affected by Western agriculture,

**Issue 3: Improving the Effectiveness of Water-Related Technologies for Sustainable Agriculture**

The bulk of current knowledge about the potential of existing and new technologies to contribute to a sustainable Western agriculture is from site-specific studies. These studies have led to the formulation of technological principles that may have general applicability. However, judgments about the potential of specific water-related technologies for sustaining arid/semiarid agriculture in the Western United States are difficult to make from these site-specific data. A principal reason for this is that the effective application of specific technologies depends on the ability of the researcher and user to adapt them to local conditions.

Moreover, the researcher's perspective about effectiveness may vary from the user's perspective; the former may be looking at technical efficiency, while the latter may be interested in economic efficiency. Research for both onsite and offsite technologies suffers from questions of relevance and practicality for a particular agricultural site and user.

**Option: Provide mechanisms for increased researcher/user interaction**

Congress could direct USDA and the Federal land-management agencies to establish user-oversight groups for their research activities in two particular areas. One user-advisory group could focus specifically on the onsite water-conserving technology needs of arid/semiarid agricultural producers and provide advice and oversight principal' to USDA. Particular emphasis could be placed on identifying and using innovative producers representing the variety of agricultural systems in the West. Local agricultural organizations could be useful sources of information to identify the most innovative producers.

A second user-advisory group could focus specifically on the usefulness of offsite water-augmentation technologies for downstream

agriculture. This user group could be comprised of innovative producers who are directly downstream from the experimental water-producing sites. The group could advise and oversee those Federal agencies responsible for water-related technologies that are applied upstream or in highland areas offsite from arid/semiarid agriculture but have potential water-related impacts for that agriculture (e. g., weather modification, watershed management, snowmelt forecasting). The linkage between researcher and user is particularly important with such water-augmentation technologies because resource manipulation often occurs some distance from the point of potential agricultural impact. A user-advisory group could provide researchers with the increased opportunity to understand downstream needs of water timing, quality, and quantity.

These user-advisory groups could report to heads of agencies and to Congress. They could provide the much needed perspective of the people who ultimately use the products of research. Such an approach could mimic the highly successful Israeli system in which agricultural researchers engage in farming and equipment manufacture as well as laboratory work. In view of the site-specific effectiveness of water-related technologies and of the focus of much of the Federal water-related research work in arid/semiarid lands, improved agricultural user-researcher communication could provide guidance to Federal agencies about priority areas for action. User groups could

assist Congress in determining whether Federal resources in these areas are producing results that justify continued Federal support or whether a refinement in focus and programs is appropriate.

Concerns about this option relate to the possible effectiveness of the user groups. At present, a National Agricultural Research and Extension Users Advisory Board (UAB) exists pursuant to legislation in the Food and Agriculture Act of 1977. A recent OTA report on the U.S. food and agricultural research system found this board's effect on USDA research priorities to be unclear. Other concerns are that researchers who interact with user groups would be taking time that might be spent otherwise with laboratory or field work. Moreover, the focus of particular users might be on short-term economic solutions rather than long-range issues involved with the development of technologies for sustainable agriculture.

In light of these concerns, the task will be to define carefully and succinctly the composition and functions of the Western user-advisory groups proposed by this option. Precautions will be needed to ensure that such groups effectively represent Western users and have the capacity to evaluate and examine objectively the work of the Federal agencies. Congress could require that users be nominated by representative agricultural organizations and have access, when needed, to scientific expertise independent of that of the Federal agencies.