Risk Management Instruments for Water Reallocations

Chad E. Hart

Briefing Paper 05-BP 46
February 2005

Center for Agricultural and Rural Development
Iowa State University
Ames, Iowa 50011-1070
www.card.iastate.edu

Chad Hart is a scientist in the Center for Agricultural and Rural Development at Iowa State University.

The author thanks Bruce Babcock, Michael Roberts, and participants at the Farm Foundation-ERS "Agricultural Risks in a Water-Short World: Producer Adaptation and Policy Directions" workshop, May 24-25, 2004, in Washington, D.C., for their comments and discussions. The views presented in this paper should be attributed solely to the author and not to the USDA, ERS, RMA, or any other individuals.

For questions or comments about the contents of this paper, please contact Chad Hart, 568E Heady Hall, Iowa State University, Ames, IA 50011-1070; Ph: 515-294-9911; Fax: 515-294-6336; E-mail: chart@iastate.edu.

This research was supported by a partnership between Iowa State University and the United States Department of Agriculture (USDA), Economic Research Service (ERS), as part of a study for the Risk Management Agency (RMA).

Executive Summary

Federal and state governments are searching for programs and/or policies to deal with the risks linked with uncertainty in water supplies and demands. Within the United States, competition among agricultural, urban, and environmental concerns for water is increasing. Drought conditions and water use restrictions have, at times, limited water supplies for these varied uses. The federal government stands in a unique position as both a major supplier and demander of water. As such, the federal government has put forward several programs for water conservation, information, and usage. One area in which the federal government has not made significant progress is the issue of risk management and compensation for water reallocations. When natural forces or government policies trigger water use restrictions, the restricted water users may or may not be compensated by current programs. This paper explores how current policies may or may not cover agricultural losses due to water use restrictions and outlines several government policy proposals and market-based methods to mitigate the risks from water restrictions. Given the diversity of the agents involved and the watersheds covered, it is likely that no one program will be the "best" program to address the issue. The "best" program for a given combination of agents in a watershed will depend upon the types of agents and the possible uses of the water.

Keywords: government policy, reallocation, risk management, water rights.

RISK MANAGEMENT INSTRUMENTS FOR WATER REALLOCATIONS

Introduction

Federal and state governments are exploring alternative mechanisms to mitigate the risks linked with uncertainty in water supplies and demands. Within the United States, we have seen increasing competition among agricultural, urban, and environmental concerns for water. Drought conditions and water use restrictions have, at times, limited water supplies for these varied uses. The federal government stands in a unique position as both a major supplier and demander of water. As such, the federal government has developed programs for water conservation, information, and usage. The increased focus of the federal government on water issues can be seen from events like the 2002 farm bill and the Water 2025 initiative. Within the farm bill, Congress provided $50 million for the Klamath Basin through the Environmental Quality Incentives Program (EQIP). For the first four months of 2004, $19 million was released. Former Agriculture Secretary Veneman has stated that the funds are addressing resource challenges in the Klamath Basin and will facilitate the implementation of practical water conservation practices for the area. The USDA has also released a report, "Partnership Accomplishments: Conservation in the Klamath Basin." The report outlines the water conservation and water quality efforts made in the region since 2001 and summarizes the effects thus far (Johnston 2004). The Department of the Interior's Water 2025 initiative is targeted at balancing the competing interests for water and establishing water management systems that protect environmental needs and strengthen local economies (Department of the Interior 2003).

One area in which the federal government has not made significant progress is the issue of risk management and compensation to water users who are forced to comply with water restrictions. When natural forces or government policies trigger water use restrictions, the restricted water users may not be compensated. This paper explores how current policies may or may not cover agricultural losses due to water use restrictions and

outlines several government policy proposals and market-based methods to mitigate the risks from these restrictions.

Existing Risk Management Tools

The current array of tools available to agricultural producers is directed mostly at curtailing water usage and not at compensating restricted users. Three programs that have compensated users in the past are crop insurance, disaster assistance, and water banks. Crop insurance has been part of the federal government's risk management arsenal since the 1930s. For most of that time, though, the program was limited in scope. Over the last two decades, the federal crop insurance program has expanded to cover over 100 commodities, with some commodities having multiple insurance plans. In 2003, the federal crop insurance program provided coverage on over 217 million acres across the nation. The total liability in the program exceeded $40 billion. Over the last 10 years, producers have paid over $10 billion for federal crop insurance and have received over $20 billion in insurance indemnities. The Risk Management Agency (RMA) oversees the program. Currently, RMA offers insurance to cover low crop yields, low crop prices, and low livestock prices. Producers can choose from several insurance coverage levels and, depending on the commodity and area, several insurance plans. Some of the insurance plans are individualized to the production unit by setting the insurance guarantee on specific data for the unit. Other plans are more regional in nature, requiring only information on the location of the unit and the crop to be insured. Coverage levels on individualized insurance plans range from 50 percent of expected yield and 55 percent of expected price, which is the minimum "catastrophic coverage" level, to 85 percent of expected yield and 100 percent of expected price. For regional insurance plans, yield coverage ranges from 65 to 90 percent of expected area yields. The crop insurance program is structured so that the government covers all expenses related to the sales and service of the insurance and also covers part of the premium for the insurance through premium subsidies. Producers pay a nominal fee and the remainder of the premium.

Crop insurance usage varies greatly in the West. In the Plains States, a majority of all harvested acres are insured. For 2002, North Dakota producers insured 19.3 million acres out of a total 19.9 million acres. Producers in Kansas, South Dakota, and Texas insured

over 80 percent of all harvested acres. In the Intermountain West and the West Coast, crop insurance usage falls. In Nevada, only 30,000 acres were insured. Crop insurance participation (on an acreage basis) was less than 50 percent in Arizona, California, Nevada, Oregon, Utah, Washington, and Wyoming. However, while total participation lagged in these states, the average value of insurance coverage in these states tended to exceed greatly the national average. In 2002, the average per-acre crop insurance liability was $176.77 nationwide. For California, that average was $723.32. In Arizona, Nevada, Oregon, and Washington, per-acre liabilities were roughly twice the national average. Much of this disparity can be attributed to the share of irrigated agriculture for these states.

The current provisions for crop insurance policies do allow for some indemnities in cases in which water restrictions have been put in place, but the situations are fairly limited. The water restriction must be due to an insurable cause, such as drought. Water reallocations due to endangered species, for example, are not covered. If the water restrictions occur after planting, insurance coverage will remain in effect if the producer had a reasonable expectation, at planting time, of receiving sufficient water for the crop. The reasonable expectation is based on information from local irrigation authorities, such as the Bureau of Reclamation, the Corp of Engineers, the Natural Resources Conservation Service, and other water rights sources (USDA-RMA 2003a). If the restrictions occur before planting, prevented planting coverage remains in effect (USDA-RMA 2003b). In the prevented planting case, the producer may opt to plant and insure a non-irrigated crop.

For crops that are not currently covered by the crop insurance program, there is a standing disaster assistance program called the Noninsured Crop Disaster Assistance Program (NAP). NAP requires producers to sign up for coverage and covers losses below 50 percent of expected production. Like crop insurance, the production shortfall must be the result of a natural disaster (USDA-FSA 2004). Thus, non-natural-disaster water reallocations or mechanical water disruptions are not covered by NAP.

Congress has also provided compensation to water-restricted agricultural producers through disaster payments. Typically, disaster payment programs are set up by Congress after some weather-related event (such as droughts or floods). Such programs were implemented for crop disasters in 1988, 1989, 1993, 1994, 1998, 1999, 2000, 2002, and

2003. The structure and amount of the payments can vary from program to program, as there is no permanent standing for this type of disaster program. The formation and reasoning behind disaster programs change with each use. Over the last several years, disaster-type payments (e.g., Market Loss Assistance payments) have been provided in cases of low prices. The pattern of usage suggests that Congress could create disaster-type payment programs for agricultural water restrictions.

Water banks have been established by federal and state governments to transfer water rights temporarily among entities. Most of the banks have been as temporary as the transfers they facilitate. One of the most well-known examples of water banking is the California Drought Water Banks of 1991 and 1992. These banks brokered the transfer of water by coordinating transfers and forming contracts for sales and purchases of water. Some of the issues that came up in the functioning of the California water banks were the balancing of water supplies and demands, anticipation of future water supplies and demands, and the restrictions of the sources of water. Other water banks have been set up in Washington, Oregon, Idaho, and Colorado for various purposes. Under the Bush administration, the "Water 2025" initiative supports the formation of water banks (Department of the Interior 2003). Both the Bush administration and a group of Klamath Basin farmers have proposed water banks for the Klamath Basin. Currently, the Klamath Basin has one water bank to assist Coho salmon in the Klamath River (Darling 2004).

Expanding Current Programs to Cover All Water Restrictions

The current array of risk management programs could be expanded to compensate entities affected by water restrictions. Crop insurance and disaster assistance already compensate for losses due to unexpected water restrictions attributed to natural disasters. Water banks have been created for a variety of reasons. But extending these programs beyond current settings comes with additional challenges.

Currently, crop insurance is offered as a public-private partnership. Private insurance companies sell and service crop insurance policies, while the federal government regulates the types and costs of insurance and provides reinsurance to the private companies. This partnership is dependant on the risk-sharing relationship between the insurance companies and the federal government. The Standard Reinsurance Agreement (SRA) is

the document that defines the risk-sharing arrangements between the insurance companies and the federal government. Insurance companies agree to sell and service crop insurance policies approved and priced by the federal government in exchange for set levels of reimbursement to cover administrative and operating expenses. A reinsurance structure is also put in place that allows companies to transfer some of the risk from crop insurance to the government while still having the opportunity to capture underwriting gains (the excess insurance premiums above indemnities in low loss years). The expansion of crop insurance to cover all water restrictions would place the federal government in the somewhat awkward position of being both the water reallocator and the insurer against water reallocations. As the federal government also controls the premiums insurance companies can charge for crop insurance, it would have to assess the likelihood and severity of its own water reallocation actions and incorporate that information into the insurance premiums. Historical data for evaluating effects of non-natural disaster water reallocations would be sparse. Urban and environmental reasons for water reallocations are likely to be more prevalent in the future. We are still learning about the ecosystem and examining the social, scientific, political, and economic ramifications of water supply and usage. The possibility of adequately assessing the full impacts of water reallocations for crop insurance seems remote.

Even if the premium impacts could be estimated, the insurance companies would then need to evaluate whether to continue selling crop insurance under such an arrangement. Under the current SRA, the insurance companies would share in the underwriting gains and losses (the excess indemnities above premiums in high loss years). If the companies believed the premium adjustments did not fully capture the impacts of all water reallocations, then they would expect additional losses under crop insurance and thus more underwriting losses. This could drive companies out of the industry. In order to avoid such a dynamic, one option would be for the federal government to assume all losses from non-natural disaster water restrictions. This would alleviate insurance company concerns about premium issues for non-natural disaster water restrictions and allow crop insurance to expand to cover this need.

If producers believe the premiums do not accurately reflect the risk of non-natural disaster water reallocations, they may change their insurance and/or their production

decisions. If producers believe premiums are too high, they will not utilize the insurance. If producers believe premiums are too low, insurance participation could (and probably would) increase. Producers might also shift crop or production choices, given the added protection and possible payments from the insurance. Whether producers would shift crops would depend on the potential indemnities from insuring alternative crops. Producers could shift to higher-valued (and possibly higher-risk) crops, but such a change would not guarantee higher indemnities. With most crop insurance products, the insurance guarantee is based on historical production on the insurance unit. If producers attempt to shift to a crop they have limited or no experience with (less than four years of production data), then the insurance guarantee is at least partially based on transitional yields. Transitional yields are RMA estimated yields that are used in computing crop insurance liabilities when actual production history is not available or is limited. Transitional yields represent county (or area) average yields. Depending on the crop, producers' records and history with the crop, and other factors, 65 to 100 percent of the transitional yield is used in the liability calculation. Thus, the liability and potential indemnity from alternative higher-valued crops may or may not be higher than the liability and potential indemnity from the original crop.

Any problems in implementing new crop insurance coverage for non-natural-disaster water reallocations will be magnified by the sheer value of irrigated crop production. While irrigated agriculture represents less than 20 percent of all harvested cropland, the value of irrigated production is roughly half of all total crop production value. The national average per-acre sale production value is $950 for irrigated agriculture and $200 for non-irrigated agriculture. This difference also shows up in crop insurance liabilities. Thus, for the same percentage loss under a crop insurance policy, the indemnity on an irrigated acre will likely be more than double the indemnity on a non-irrigated acre. Irrigated agriculture potentially could dramatically affect the crop insurance industry. Based on current averages, the movement of 8 million irrigated acres into or out of crop insurance (a less than 4 percent shift in total insured acres under crop insurance) would shift liabilities by roughly $4 billion (a 10 percent change) and change premium and indemnity figures by tens of millions of dollars. If incentives are present to induce producers to move to higher-valued crops, then the shifts could be greater.

Disaster assistance could easily be shifted to cover water reallocations not related to natural disasters. Congress sets the rules and coverage for disaster packages. Thus, Congress could, at any time, decide to provide such protection. Similar types of crop and production distortions could occur with disaster assistance as with crop insurance. But producers have the added advantage of not having to pay a premium for the coverage. Disadvantages are that coverage is likely to be less than for crop insurance, disaster assistance is currently given on an "as needed" basis (there is no standing program), and the ability of Congress to provide disaster assistance depends on the economic and political situations at the time. Typically, disaster assistance packages have been created without offsetting spending cuts in other federal programs because the disaster programs are considered "emergency spending." However, this was not the case with the most recent agriculture disaster package. Budget offsets were required before Congress could pass and the President would sign disaster legislation. If budget offsets continue to be required, the likelihood of future disaster assistance packages will be diminished.

The federal government could establish water banks to facilitate water transfers in water-short years; however, this would require extensive planning. Water banks require many of the same conditions that comprehensive water markets would (many of these conditions are discussed in a later section). Balancing water supplies and demands over the numerous watersheds in the West would be difficult. The government would need to draft and enforce binding contracts among various entities and protect conserved water as it flowed to downstream users. Monitoring systems, such as meters, may be required to check and enforce transfers. Wide-scale implementation of water banks would require an educational effort of the government to inform potential buyers and sellers of water rights about the mechanisms of a water bank. Also, some state laws may limit water bank usage if they restrict the type of user or the potential usage of the water.

The Klamath Basin water banks for 2003 and 2004 highlight some of the issues water banking faces. The water banks are being created to assist Coho salmon in the Klamath River. In 2003, the Bureau of Reclamation set up a 50,000 acre-foot water bank, paying $187.50 per acre for idled land and $75 per acre-foot for well water. These prices were determined by the Bureau and were not negotiated. The total cost for the bank was $4.75 million. For 2004, the Bureau needed to acquire 75,000 acre-feet in the bank and

had set aside $4.5 million. Prospective participants were allowed to bid to sell water to the bank. Roughly 400 bids were offered, encompassing nearly 60,000 acres and 140,000 acre-feet. The bids ranged from $30 to $150 per acre-foot.

Thus, the region has had water banks over the past two years from the same government agency. But the rules of the bank have shifted between the years. The money allocated to the bank has decreased while the amount of water needed in the bank has increased. The government agency running the bank (the Bureau of Reclamation) has a disagreement with the government agency ordering the bank (the National Oceanic and Atmospheric Administration) over the accounting of river flows. Representatives on various sides of the water question are tentatively supportive of the banks but do not see the banks as a long-term solution to the issue. Funding concerns were raised by groups representing water users (farmers and ranchers) and fishermen. The farmers and ranchers appreciate the compensation for their water usage but worry about the trends for both the water required in the bank (increasing) and the money allotted to the bank (decreasing). The fishing association is also concerned about funding and would prefer a permanent transfer of certain water rights, as opposed to the temporary transfers through the water banks (Darling 2004).

So while existing programs could be expanded to compensate for water reallocations, it may not be in the government's or the irrigators' best interest to do so. Also, any expansion of these programs would have to address the constitutional issue of property taking. Amendment 5 of the U.S. Constitution states "… nor shall private property be taken for public use, without just compensation." If the water reallocation is considered a taking under the Constitution, then the payments from the expanded programs would need to be justified as appropriate compensation. The issues of property taking and compensation would arise under most, if not all, of the possible policies for dealing with water shortages. Crop insurance, disaster assistance, and water banks are the current tools we have at hand for compensation of water reallocations, but there are several other alternatives that could be used to facilitate water transfers and compensate restricted water users. The next section explores some of these options, namely, tradable bonds, buyouts, and contingent water leases.

Alternative Policies

Water banks represent one type of market-based policy to address water shortfalls. Market-based policies are attractive because they can be effective water transfer mechanisms while at the same time providing information on the value of water usage (in crop production or other uses) and shifting usage to higher-valued enterprises. However, the rules and time horizons for such policies may make them more or less attractive to concerned entities.

Another market-based policy that would compensate agents affected by water reallocations is the trading of bonds that would pay out when water is reallocated. These bonds offer several advantages as a federal compensation package. First, the government could budget for the expense of the compensation, as the bond values set the compensation. Second, the bond purchases and sales could be allowed to secondary agents, such as agricultural input suppliers, businesses related to recreational water activities, and small communities, which are indirectly affected by the water reallocations through lost business opportunities, depressed sales, and lost economic activity. In many water reallocation disputes, such as the situation at Klamath, it is these secondary agents who are most vocal in expressing their concerns about reallocation and compensation. Third, if bond trading were allowed, market forces would establish the prices for the bonds and the bonds should flow to those who place higher values on the water usage. Also, the initial sale of the bonds could at least partially finance the bond payout. Fourth, agents would be able to select their "protection level" from water reallocations by their amount of bond purchases. Fifth, because the bonds are not tied to any agricultural production, they should not affect production or crop decisions.

However, tradable bonds do have several drawbacks as well. The government must establish, at the outset, the value of the bonds and thus the value of water reallocations. Rules would need to be created to govern the allocations, transactions, and conditions of the bonds. The government would need to be transparent in its decisions about water restrictions to avoid the possibility of "insider trading" of the bonds. An educational effort would also need to be made to inform possible bond users on the function of the bonds and the rules attached to them. The constitutional question of "just compensation" would still be an issue with the bonds. If the bonds were initially distributed through an auction, restricted

users would not receive compensation without participating in the auction. Thus, even though the value of the bonds is large enough to compensate people justly for the reallocation, the compensation mechanism may fail the constitutionality question.

Water rights buyouts are another type of market-based policy that addresses water reallocations. The buyouts could be triggered for any reason, so the nature of the water reallocation is not material to the compensation. The buyouts could be temporary (for a set period of time, such as a year) or permanent. Buyouts provide direct compensation to restricted water users, but secondary entities may remain affected by the reallocation without any compensation. Temporary buyouts are less likely to be opposed by secondary agents, as they are less likely to permanently disrupt economic activity in the area. Permanent buyouts trigger, at a minimum, changes in the production practices on farms and may lead to the land being used for other purposes. To many communities, such changes could have dramatic effects on the local economy. Another issue with buyouts is the cost of the program. Depending on the government's approach to addressing secondary agents, the cost of buyouts could be extreme.

The market-based policy that may have the least government budget exposure is the creation of contingent water leases. These leases can take many forms, with conditions on the timing, cost, length, and effects of the water reallocation. The conditions might limit the water transfers to avoid economic disruption to the affected community, might restrict the number of times a transfer can occur, or might set specific factors that must be met before a transfer occurs. Thus, the leases work like options. In this case, the buyer of the lease can obtain temporary control of the water in question for a set price given the conditions of the lease. The leases can be structured to be triggered by a variety of events, such as drought conditions, urban demands, and wildlife statistics. Since the leases can be constructed based on conditions for both the buyers and sellers of the lease, both parties can benefit. The buyer of the lease obtains water rights during conditions likely to be beneficial to them. The seller of the lease maintains long-term control of the water rights and direct compensation for any reallocations. Secondary agents do not face permanent disruptions, as the water reallocations are temporary.

Contingent water leases can also be self-sufficient, in that the government may not need to subsidize the leases if the money exchanged by the lease buyers and sellers is

enough to cover the costs. Several studies have looked at the possible self-sufficiency of contingent water leases among agricultural, recreational, and hydrological power interests and found that leases can be constructed that minimally disrupt water allocations yet still provide positive benefits to lease buyers. The studies suggest that the economic activity generated by the water reallocations would greatly exceed the additional value generated in the original water use by not restricting the water. In their 1992 study, Hamilton and Whittlesey (1992) found that the cost of diverting water from some Idaho agricultural production was around $2.50 per acre-foot, while the additional power generated by hydroelectric power plants from such water was estimated to be valued at between $5 and $7 per acre-foot.

The issue with contingent water leases is that compatible buyers and sellers must be found and the conditions must be beneficial to both parties. It may be easy to envision situations where drought-contingent leases between power companies and irrigating producers benefit both entities. Another example would be leases contingent on drought or urban demand between cities and irrigating farmers. It is harder to come up with workable examples for wildlife-induced contingent leases that would be self-sufficient. But the government could also stand in as a lease buyer in these situations. If the government were interested in pursuing contingent water leases as a solution to water allocation issues, then the government would also face the cost of searching for compatible agents, setting up beneficial leases, and enforcing those leases.

Issues with Market Approaches

Market-based approaches would attempt to allow water usage to be allocated in an efficient manner. However, the nature of the good in question (water) and the rules regarding its current allocation and usage may restrict the efficiency gains. Jaeger and Doppelt (2002) discuss eight conditions for property rights and markets that define efficient markets:

1. Individual ownership, control, and impact
2. Completely specified rights
3. Transferable rights
4. Complete and costless enforcement of rights

5. Standardized product
6. Perfect information
7. No market power
8. All other resources are mobile

Individual ownership, control, and impact refers to the rights, rewards, and costs of the owner of a resource. To have individual ownership, control, and impact; the owner must have exclusive rights to the resource, capture all benefits and accrue all costs of owning the resource, and the impact of the owner's actions with the resource cannot affect other individuals. For an owner to have completely specified rights, the rights, and all associated restrictions, must be known by all individuals. Transferable rights indicate that the rights to the resource can be bought or sold. Complete and costless enforcement of rights implies that the rights and restriction of ownership are enforced at no costs to society.

A standardized product means that the resource being traded is identical in all senses across all transactions. Resources that differ because of location, timing, quality, and so forth are not standardized. Perfect information refers to the amount of information available to market participants. In a market with perfect information, all buyers and sellers have all information available to them at no cost. The condition of no market power refers to the ability of buyers or sellers to influence the market. If buyers or sellers are able to influence market prices, then they have market power. The condition on the mobility of other resources implies that any other resources inseparable from the resource being traded can also be obtained.

Water markets would face problems in meeting any of these conditions. Water ownership is not exclusive and the water user's actions can have definite impacts on other individuals. Water ownership is not completely specified throughout the West. The ability to transfer water rights is limited in many cases. Enforcement of rights depends on the ability to monitor water usage. Currently, most water allocations are not effectively monitored through water gauges or meters.

Water is definitely not a standardized product, in that it is differentiated by location, timing, and quality. Water in the upper Mississippi in the early spring does not have the same value as the same quantity of water in the Upper Klamath Basin in the spring. Information on the water transactions that have occurred in the recent past can be hard to

find, and finding current water valuations is even tougher. The federal and state governments and larger irrigation or municipal water groups may have sizable market power in any possible water markets. Many of the resources utilized with water (irrigated land, agricultural equipment, fish and wildlife) cannot be easily transferred.

However, Jaeger and Doppelt discuss these issues and also provide recommendations to alleviate some of the problems. These recommendations include developing collaboration, communication, and solutions among irrigation districts, irrigators, other water users, and local communities; clarifying water rights and transfer rights; being open to several types of transfers; establishing a central clearinghouse on water transactions and information; improving monitoring infrastructure; and conducting additional research on the biological impacts of water flow changes.

Estimates and Transactions

In another paper, Jaeger (2004) provides an example of the possible efficiency gains from a water market in the Upper Klamath Basin. Jaeger examines the distribution of annual per-acre net revenues for the 425,000 irrigated acres in the basin. In looking at net revenues, Jaeger considers the gross revenues from the irrigated production and the costs associated with that production. The net revenue values are used as implicit water values for the study. The revenues range from $25 to $400 per acre. If irrigation needed to be restricted on 50,000 acres in the basin, the cost would vary from $1.25 million if acres with lower net revenues were restricted to $8.5 million for higher net revenue acres. Targeting the restriction at the lower-revenue acreage would save up to 85 percent on the cost of the restriction. Allowing producers in the basin to exchange water rights (or water restrictions) could benefit both producers on high and low net revenue acres. Given the range in net revenues, there exist prices such that producers on high (low) net revenue acreage would be willing to buy (sell) water rights in the event of a water shortage. For example, let us look at two producers, one with an expected per-acre net revenue of $25 and the other with expected per-acre net revenue of $400. The producer on the low-revenue acreage would likely accept any bid that netted more than $25 per acre for water rights, while the producer on the high-revenue acreage would likely offer up to $400 per acre to ensure water rights. The transactions would

facilitate water transfers that would maintain production on high net revenue acreage while providing a revenue stream to producers who would refrain from production on low net revenue acreage.

The Jaeger study also highlights the large amount of variability in water values, even within one watershed. Other estimates of water values and costs, detailed next, show a tremendous range. In thinking about the costs of managing water allocations for future events, this variability in values implies that the case studies mentioned in this report may or may not be representative of values throughout irrigated agriculture.

Gollehon (1999) reported on water market transactions in 1996 and 1997 in the West. He found large variations in price for both permanent and temporary water transactions. For permanent transfers, prices ranged from $77 per acre-foot in Idaho to $4,950 per acre-foot in Nevada. Temporary transfers had lower prices, from $3 per acre-foot in Montana to $979 per acre-foot in Utah. The majority of the reported transactions were permanent transfers, but most of the water in the transactions was only temporarily transferred.

Jaeger and Mikesell (2002) explore several different methods in valuing water transfers. They first obtained transaction data from the Oregon and Washington Water Trusts. In Oregon, permanent water rights purchases averaged $9 per acre-foot, whereas one-year leases averaged $23 per acre-foot. Next they looked at water values derived from land prices from a 1999 study by Faux and Perry (1999). The value of water from that study ranged from $9 per acre-foot for land with poor soils to $44 per acre-foot for land with high-quality soils. Water value estimates from economic models were also considered. Gibbons (1986) studied the costs of unexpected irrigation reductions and found values ranging from $20 to $565 per acre-foot, depending on the crop in question and reduction size. Jaeger and Mikesell (2002) also discuss contingent contracts and indicate that such contracts would lower the cost of diversion. In comparing the values between the Gollehon and Jaeger and Mikesell papers, one must consider the different contexts of the transfers. Most of the transfers in the Gollehon study were among irrigators and urban water users. The Jaeger and Mikesell study examined water transfers to create greater streamflow for salmon.

Concluding Remarks

The issue of water rights and reallocation will only grow in importance in the future as the demand for water increases with population growth and movement, agricultural production, and recreational use. In this paper, I examine several existing and potential methods for compensating water rights holders when water reallocations are required. Each of these methods has advantages and disadvantages; no one program truly dominates another. There are differences in costs (both to the government and to the affected parties), organization, and effect.

Crop insurance is the only permanently standing government program that could be expanded to reimburse agricultural producers for water reallocations. However, the expansion may dramatically increase program costs, affect the partnership the federal government has with private insurance companies, and affect the production decisions of agricultural producers because of the additional coverage. Disaster assistance could also be extended to cover water reallocations but would face many of the same issues as crop insurance. Additionally, producers would be receiving protection from water reallocations free of charge under the assistance.

Water banks have been or are currently being used by the federal and state governments in several watersheds. The banks represent a move toward market-based solutions to the water reallocation problem. But the results have been mixed. The rules governing the banks have shifted with each incarnation. Creating water banks across different watersheds and legal jurisdictions would be problematic.

Other market-based approaches, such as tradable bonds, buyouts, and contingent water leases, have definite advantages and disadvantages to them as well. The most obvious advantage is that water and/or bond values would be set by the market. Tradable bonds could allow individuals indirectly affected by water reallocations to receive compensation. The tradable bonds and buyouts provide governments with manageable ways (in a budgetary sense) to reimburse affected individuals. The possibility for contingent water leases that do not require government subsidization exists.

However, as Jaeger and Doppelt discussed, market-based approaches to water must overcome several obstacles. The myriad of state and federal laws governing water rights must be put together in some cohesive fashion. Unspecified or unclear water

rights must be straightened out before transactions involving them can occur. Effective monitoring of water will be required to support market transactions. Also, the constitutionality of water reallocations and compensation must be addressed by any approach in dealing with water shortages.

Data from various studies and reported water transactions show the tremendous amount of variability in water values. This variability exists not just across the entire West but also within individual watersheds. There are many facets of water supply and demand that influence the value. The location, timing, and quality of the water have a direct impact on the value. Any government program attempting to capture adequately the value of water must be flexible enough to adjust to a range of market conditions.

Given the diversity of the agents involved and the watersheds covered, it is likely that no one program will be the "best" program to address the issue. The "best" program for a given combination of agents in a watershed will depend upon the types of agents and the possible uses of the water. The federal government has a unique role here, in that the government could be both the entity restricting water usage and the compensator for such restrictions. The effect of water reallocations can also be felt by secondary agents, such as farm input suppliers and rural communities. The government must also decide if and how it might address the economic impacts of water reallocations on these secondary agents.

References

Darling, D. 2004. "Times Tight for 2004 Klamath Water Bank." *Agriculture Weekly* (Capital Press, Salem, OR). http://www.capitalpress.info/main.asp?Search=1&ArticleID=8731&SectionID=67&SubSectionID=792&S=1 (accessed May 18, 2004).

Faux, J., and G.M. Perry. 1999. "Estimating Irrigation Water Value Using Hedonic Price Analysis: A Case Study in Malheur County, Oregon." *Land Economics* 75: 440-52.

Gibbons, D.C. 1986. *The Economic Value of Water*. Washington, DC: Resources for the Future.

Gollehon, N.R. 1999. "Water Markets: Implications for Rural Areas of the West." *Rural Development Perspectives* 14: 57-63.

Hamilton, J.R., and N.K. Whittlesey. 1992. "Contingent Water Markets for Salmon Recovery." Working Paper, Washington State University.

Jaeger, W.K. 2004. "Potential Benefits of Water Banks and Water Transfers." Water Allocation in the Klamath Reclamation Project, Brief #2. Oregon State University Extension and Experiment Station Communications. http://eesc.oregonstate.edu/agcomwebfile/edmat/EM8844-E.pdf (accessed August 16, 2004).

Jaeger, W.K., and B. Doppelt. 2002. "Benefits to Fish, Benefits to Farmers: Improving Streamflow and Water Allocation in the Northwest." Working paper. Department of Agricultural and Resource Economics, Oregon State University. http://arec.oregonstate.edu/jaeger/water/cwchwaterbenefits.pdf (accessed August 16, 2004).

Jaeger, W.K., and R. Mikesell. 2002. "Increasing Streamflow to Sustain Salmon and Other Native Fish in the Pacific Northwest." *Contemporary Economic Policy* 20: 366-80.

Johnston, J. 2004. "Washington Watch: USDA Releases $7.3 Million for Klamath Basin." *AgWeb.com.* http://www.agweb.com/news_show_news_article.asp?articleID=107903&newscat=AW (accessed April 26, 2004).

U.S. Department of Agriculture, Farm Service Agency (USDA-FSA). 2004. "The Noninsured Crop Disaster Assistance Program (NAP)." Disaster Assistance Program online. http://disaster.fsa.usda.gov/nap.htm (accessed August 19, 2004).

U.S. Department of Agriculture, Risk Management Agency (USDA-RMA). 2003a. "Facing Drought Challenges: Irrigation and Prevented Planting for 2003 Crop Year." RMA online, 2003 News Archive. February 28. http://www.rma.usda.gov/news/2003/02/drought.pdf (accessed May 1, 2004).

———. 2003b. "Irrigation and Prevented Planting." RMA online, 2003 News Archive. April. http://www.rma.usda.gov/news/2003/04/PreventedPlanting.pdf (accessed April 30, 2004).

U.S. Department of the Interior. 2003. "Water 2025: Preventing Crises and Conflict in the West." Web site Initiatives information. May 5. http://www.doi.gov/water2025/Water2025.pdf (accessed May 18, 2004).