

Economic Incentives for Agriculture Can Promote Water Conservation

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Abstract

Water conservation is defined as any decision that promotes a reduction in water use over time that pays for itself in added benefits. Allowing water right owners to market their water can promote water conservation. Reduced water supplies in droughts increase the value of water to all users. Agricultural use of water is more responsive to price than municipal and industrial use, while the price of water in cities is more responsive to shortages than in agriculture. Since agriculture owns most of the water in the Rio Grande Basin, farmers could have an economic opportunity to increase their profits by charging cities and others for temporary use of water. However, the "use it or lose it" principle of western water law may create a barrier to temporary water transfers. This barrier could be overcome by enacting legislation that declares short-term water transfers from agriculture to be a beneficial use of water. Such legislation could create a market by providing a profit incentive for farmers: They could earn money by reducing irrigation and transferring that water to other uses. Population growth and increased environmental demands will continue to promote water transfers from agriculture to cities. As agricultural land goes out of production, farmers stand to benefit economically in drought periods if they actively participate in modifying institutional barriers that allow them to earn a profit by voluntarily transferring water to other uses.

What is Water Conservation?

Pinchot once said that conservation is the use of natural resources for the greatest good for the greatest number for the longest time (Pinchot 1947). In the arid west, water conservation means little unless it is based on economics. We define water conservation as any decision that promotes a reduction in water use over time that pays for itself. Setting up plans to mitigate the economic damages inflicted by drought poses special challenges for water conservation.

Price Sensitivity of Water Use

In drought periods, reduced water supplies increase the value of water to all users. These reduced supplies typically require agriculture, municipal and industrial (M&I) users, power utilities, and environmental users to reduce their demand for water and/or look for other sources of supply.

The price elasticity of demand measures the percentage change in use of water from a one percent change in water price. Necessities that are cheap, such as salt, have a low price elasticity. Luxuries, or expensive things such

as home appliances, have a high price elasticity. A high price elasticity means that small percentage changes in price cause a large change in quantity demanded.

High price elasticities characterize water demands for irrigated agriculture. Depending on the crop, soil, climate, weather, and period of adjustment, price elasticity ranges from -1.0 to -3.0. A small percentage change in the price of water causes major impacts on agriculture. Farmers typically respond to increases in water prices by making three kinds of adjustments: (1) substituting between water and other inputs, (2) changing the crop mix on irrigated land, and (3) reducing total irrigated area. Overall, the use of water in agriculture is more responsive to price than for M&I.

The price of water in cities is more responsive to shortages than in agriculture. For example, from the price of bottled water at grocery stores, people are willing to pay up to \$80,000 per acre foot for drinking water. Cities typically charge their customers more than \$300 per acre foot. What this means is that cities are usually willing to pay considerably more to assure needed supplies in drought than is agriculture.

The low demand elasticity for M&I water means that city demands in periods of shortage could provide a ready market for temporary use of agricultural water. For example, farmers in Elephant Butte Irrigation District (EBID), New Mexico can use the elasticity concept to their advantage by recognizing that there are 500,000 people in El Paso who are willing to pay much more for water than a farmer would lose by taking it out of agriculture.

Economic Opportunities for Agriculture in Short Term Water Transfers

Since agriculture owns most of the water in the Rio Grande Basin, farmers have an economic opportunity to increase profits in dry years by charging premium prices to cities and others who need wet surface water.

Water transfers within agricultural regions is an old practice. For example Maass and Anderson (1978) describe an effective water marketing arrangement that has been in effect in one area of Spain since the 15th century. There are also vast numbers of water trades among farmers throughout the Western United States (Lund and Israel 1995). The economic literature describing the merits of voluntary water transfers is huge (Milliman 1959; Hartman and Seastone 1970; Howe et al. 1986).

Obstacles to Short Term Water Transfers

Agricultural water right owners in prior appropriation western states worry that short term transfers, such as leasing water into a bank, may cause them to forfeit their right because of nonuse. The "use it or lose it" principle of the prior appropriation doctrine may create a barrier to temporary water transfers from agriculture, and thus limit wet water available for cities. Legal considerations are especially important when a proposed transfer involves changes in conditions stipulated by the original water right, such as changes in type of use, place of use, or time of withdrawals. This fear of losing water right is a serious obstacle to farmers entering into a voluntary transfer.

New Mexico and other western states could deal with this barrier by enacting legislation that declares short-term water transfers from agriculture to be a beneficial use of water. Such legislation could create a market condition by providing a profit incentive for farmers to conserve water in exchange for cash.

Another obstacle to transfers of wet water from agriculture to cities is a lack of adequate infrastructure to divert water in New Mexico's Rio Grande Basin. Albuquerque currently has no infrastructure to divert water from the Rio Grande for its municipal use, and will need a permit to divert water once their infrastructure is built (Daves 1997).

Responses in Agriculture to Water Transfers

Water transfers from agriculture typically produce one or more of the following responses: fallowing (not irrigating) fields, shifting to lower water-using crops, substitution of groundwater for surface irrigation supplies, increased groundwater pumping, conserved water, and releasing water from reservoir storage. Each of these responses could produce cash for agriculture; and by reducing water usage in agriculture, free up some for other uses.

Possible Arrangements for Short-Term Water Transfers

There are many types of water transfer arrangements that would provide an economic opportunity for agriculture to mitigate drought damages. Included are contingent transfers/dry-year options; spot market transfers; water banks, transfer of reclaimed, conserved, and surplus water, and water wheeling or water exchanges (Lund and Israel 1995).

Contingent Transfers/Dry-Year Options. Sometimes potential water buyers are less interested in acquiring permanent water supplies than in increasing the predictability of their water supply system during drought periods. For these cases, temporary transfers contingent on water shortages may produce a payoff for both parties. The buyer would pay agriculture a sum of money for the privilege of exercising the right to use water in an emergency situation. The buyer would also pay agriculture an extra sum if that right is actually exercised. Advantages of contingent transfers for agriculture are the immediate acquiring of cash when the contract is made and additional revenues if the contingent transfer option is called. The advantage to the buyer is access to wet water when it's most needed.

Spot Market Transfers. Spot market transfers are short-term transfers, typically agreed to and carried out within a single year. These transfers are typically set up by some sort of bidding process, often with some of the conditions for transfer, such as price or quantity, being fixed (Lund and Israel 1995). The advantage of a spot market transfer for agriculture is the immediate infusion of cash when the transfer takes place.

Water Banks. Water banks are a special form of a spot market that is organized and operated by a central banker, such as the state or perhaps a group of water utilities. A water bank is a mechanism for willing owners of water to lease water to the "bank" for re-lease to "renters" on a short term basis (Pratt 1994). The banker is responsible for organizing the leasing and for keeping track of the supply and demand for money and water. A water bank is characterized by flexible, temporary transfers of water without changes of ownership. Bank participants may be different each year.

The California Drought Emergency Water Banks of 1991 and 1992 are good examples of cases in which the terms and price of transfer were essentially fixed, with the State of California acting as a banker (California Department of Water Resources 1992, 1993a, 1993b; 1993c; Rich 1994; Jerich 1997).

The State acquired water in three ways: by paying farmers for water they would have used to irrigate their fields resulting in unused water flowing past their farms, by purchasing surplus water from local irrigation districts, and by paying farmers or irrigation districts to use groundwater instead of surface water (Rich 1994). In both physical and financial terms, the 1991 California Drought Water Bank was the largest set of regional water trades to occur so far in the United States (Howitt 1991).

The 1991 Water Bank taught water managers a number of important lessons (Dziegielewski et al. 1993): (1) water markets, even when they are severely controlled and constrained, will work; (2) water has a high value for many buyers, and there are many willing sellers, (3) very large amounts of water can be found if money is put on the table, and (4) third-party interests in market transactions can be protected.

Wheeling and Exchanges. In the power industry electricity is commonly wheeled through the transmission system between power companies and generation plants to reduce the cost of power and to get it to where it's needed most at the right time. Water can be similarly wheeled or exchanged through water conveyance and storage facilities to improve the performance of the system (Lund and Israel 1995). An example is the use of a parallel lined canal owned by somebody else rather than using one's own unlined canal to deliver water.

Seasonal wheeling of water is common in agricultural regions in which different areas have complementary demands for water over time. For example the City of El Paso needs wet surface water flows in the Rio Grande in the winter, while the EBID has limited need for its channel capacity in winter. So seasonal wheeling may provide opportunities for El Paso to exchange water with EBID during EBID's low-flow demand season, with repayment coming in the form of added water and/or cash during EBID's high-demand season.

By paying farmers not to use their water, the foregone water use becomes available for nonagricultural uses downstream. The use of wheeling to meet environmental uses in the Rio Grande Basin could involve the use of storage facilities to release water for instream flows when desired. A good example would be releases by the Middle

Rio Grande Conservancy District from its El Vado Reservoir storage to produce streamflows for the silvery minnow.

Transfer of Reclaimed, Conserved, and Surplus Water. The purchase of water made available by reclamation or reductions in water demands is a form of a water transfer. Recently the Metropolitan Water District (MWD) of California set up a 35-year contract to pay the Imperial Irrigation District (IID) several million dollars for canal lining and other system improvements in exchange for the water conserved. Israel and Lund report estimated savings at 100,000 acre feet per year from IID's Colorado River water supplies. This similar potential for a mutually beneficial trade exists between the City of El Paso and EBID.

A Role for Agriculture in Promoting Water Transfers

Future population growth and increased environmental demands will ultimately transfer water from agriculture to cities in the Rio Grande Basin. Farmers stand to benefit economically from drought if they take the lead in the planning process for water transfers.

Issues Needing Resolution

If water transfers are to play a meaningful role in coping with drought in the Rio Grande Basin, a number of policy issues must be resolved.

- How should we deal with the possibility that water banking may stimulate water use that would not otherwise take place? If farmers are paid to reduce water use, some may start using as much water as possible to establish a higher historical level of use.
- There may be problems arising from failing to account for the interrelationship of surface and groundwater.
- Most two-party transfers between agriculture and some other water user will affect various third parties, such as local communities and environmental interests. Some mechanism is needed to assure that all interests are protected.
- Market-based water transfers are likely to work better in places with an extensive system of conveyance and storage facilities and well-coordinated operations. Locations with restricted conveyance and storage facilities are likely to have less potential for making water transfers work.

Summary and Conclusions

Water in agriculture is more responsive to price than water is in other uses. By responsive, we mean a small change in price leads to a large change in quantity used. Owners of agricultural water rights can use this price responsiveness to their advantage by renting or leasing their water to other users. The "use it or lose it" principle of the Prior Appropriation Doctrine is a barrier to temporary water transfers because trading is not typically considered a beneficial use of water. Removing this barrier can increase profits to those water uses who choose to rent their water in a water short year, and can reduce the cost to cities of securing needed water.

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