An Overview of Water Scarcity and Water Market Development

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Introduction

Water scarcity is one of the most complex and pressing issues facing the arid western US. Compared with other economic sectors, irrigated agriculture remains the largest user of freshwater accounting for approximately between 70 and 95 percent of total water withdrawals. Demand for water is growing and increasingly represents urban interest whose priorities for water use are divided among recreation, protection of wildlife and habitat, and human consumption. Farmers are named as defendants in a number of lawsuits in the west, including Nevada, where the competition for water is fierce and occasionally volatile.

Water shortages and quality issues are likely to worsen over time. Water crisis management is not the answer, nor is the use of collaborative processes with no definable endpoint. The U.S. Department of Interior in their report titled, Water 2025: Preventing Crises and Conflict in the West (1998) outline several options for addressing anticipated water conflict. These include more efficient water uses, cut back and/or eliminate existing water uses, develop alternative water resources (cloud seeding and desalinization) and transfer water between existing and new uses through market-based mechanisms such as water banking.

Market-Based Approaches to Manage Water Conflict

The development of water markets increasingly is proposed to satisfy increased water demand and resolve water disputes. In theory, the market place can direct the flow of water from lowest to highest value. Benefits to society from market-based water transfers include the provision of water for recreation and urban consumption plus increased in-stream flow to protect wildlife habitat and ecosystem health. In an effort to consume less water and consequently provide water in exchange for revenue, farmers may be more likely to invest in more efficient irrigation technology or grow less water intensive crops. In over-allocated systems, market-based transfers could result in additional water supplies to help expand existing farm operations, “make whole” junior appropriators or supply other competitive nonagricultural uses.

A water bank is a typical example of market-based water transfers that features a centralized institution that facilitates negotiated voluntary water transfers for a specified time-period without a permanent change in water rights. In order for a water bank to function, there must be institutional arrangements to legalize short-term transfers, a centralized system to monitor release and delivery of banked water, adequate hydrologic capacity to allow storage and delivery without significant water loss to users and water users who desire and are able to rent water.
The centralized aspect of a water bank, in particular, can reduce transactions costs through identifying the suppliers and demanders of short-term water transfers, negotiating price paid for water and facilitating the storage and delivery of water to users at the appropriate time and location.

Individual economic incentives for farmers to participate in water banks involve strategic fallowing of fields. When the anticipated market price for an annual crop is significantly low or when rotation of perennial crops is necessary or timely, a farmer may choose to fallow fields and receive cash revenue for water. In years when farmers may need to fallow fields, a water bank offers the opportunity to potentially increase or stabilize a farmer’s income. This may mean the difference between some farmers remaining in business or selling out.

In western states where water rights typically are already fully or over adjudicated, market-based water transfers can serve as a potential tool to manage scarce water resources. In spite of obvious economic incentives, barriers to the development of water markets are widely documented. Much of the research on barriers focus on third party effects and a perceived threat to water rights as established through Prior Appropriation Doctrine. Additional potential barriers involve hydrologic limitations and potential negative economic externalities. Potential social barriers involve farmers’ reluctance to participate in a solution they may perceive as foisted upon them either through governmental intervention or by special interest groups.

**Potential for Third Party Injuries and Negative Economic Externalities**

**Legal Considerations**

The Prior Appropriation Doctrine, established in the 19th century, provided incentives to develop western territories by developing water resources for mining and agriculture. The concept was based upon a simple premise of beneficial use; the first to prove a beneficial use for water established the perpetual right to use water. Conversely, if appropriated water went unused for a consecutive number of years then the water user would lose that appropriated entitlement. This aspect of western water law still governs water use.

Although prior appropriation protects the integrity of early water allocation, in terms of water bank development, it can lead to economic externalities and third party effects. One such effect involves continuous nonuse of water. Since prior appropriation stipulates that farmers risk losing their water entitlement if they continually do not use excess water, farmers are not motivated to admit, much less advertise, that they have excess water for sale. A potential third party effect from water banking involves the possible increase in consumptive use of water. Consumptive use is that portion of diverted water removed from the hydrologic system by irrigation, industrial use, evaporation, transpiration or other manner. The return flow is the difference between the amount of water diverted and consumptive use. The return flow reenters the system and becomes available for use by others, including junior appropriators. Water banking may motivate increases in water use efficiency, which may decrease water diverted for crop production with the excess being leased. This action may ultimately increase consumptive use and therefore result in less return flow to the system available to junior appropriators.

Similar third party effects are possible also if water that is transferred changes place and purpose of use. Prior appropriation stipulates specifically where and how water is to be used based on point of diversion. If water changes point of diversion, timing or purpose of use as a result of water banking, this could also affect the hydrologic supply for others through a change in return flows.

An irrigation system regulated by Prior Appropriation Doctrine, however, precludes water diversions to be decreased consistently without decreasing the amount of land irrigated and ultimately modifying the water right accordingly. This aspect of the law has served as a system of checks and balances to assure that water entitlements are allocated to support the historical definition of beneficial use, which is to reclaim desert lands through irrigated agriculture. To avoid third party effects associated with possible increases in consumptive usage, water law would have to be modified to account for improvements in production efficiency that enable farmers to consistently decrease both their diverted amounts and return flow coincidently. Additionally, changes to Prior Appropriations Doctrine specifically must update and define more clearly “beneficial use,” which currently limits how water is to be used, and designated place of use, which legitimizes the withdrawal of water. To enable water banking to function effectively as an institutional mechanism, Prior Appropriation Doctrine must be modified to protect water rights holders who participate.
Hydrologic Considerations

Hydrologic considerations are simpler in comparison to legal considerations. Sufficient capacity within a river basin is needed to store and deliver water at required times to specified users. Ditch and canal infrastructure must be adequate to deliver water with the least amount of evaporation possible. This may require ditches be concrete-lined and consolidated. Automated flow measurements and water delivery can also facilitate efficient delivery. A centralized entity, such as an irrigation district, must exist to oversee and arrange transactions, monitor the physical movement of water to users and attend to operations and maintenance details.

Economic Considerations

It is difficult to anticipate precisely the economic impacts of water banking. Leasing water to nonagricultural uses instead of crop production would likely diminish the demand for agricultural labor. It may also negatively impact agriculture related supply businesses. Combined effects may ultimately reduce the tax base of rural communities. In addition, fallow fields may encourage invasive weed infestation. Long-term weed control can become cost-prohibitive, depending upon the weed species.

To avoid fallowed fields, farmers may have to adopt a mix of water conservation measures to enable them to bank water and keep fields under less water intensive cultivation. Farmers can respond to water shortfalls by choosing to produce higher-value crops. Adoption of drip irrigation technology or dry land alternative crop production provides options but require additional investment.

In short, economic incentives to participate in a water bank must balance the potential costs of participation. Obviously, water banks could reduce transactions costs for farmers who currently negotiate lease prices and timing of delivery amongst themselves. This savings should factor into and buffer additional costs farmers bear when implementing a new management strategy or technology to avoid fallowing fields completely.

Social Considerations

Water disputes that arise from an attempt to establish a new institutional arrangement to allocate water are particularly complex. There are a number of diverse interests at the table to outline their demands. Many interests may elect to work behind the scenes through political lobbying which further complicates the dispute. Multi-generational farm families may feel personally attacked and violated by the onslaught of new competitors and new institutions for water allocation. Emotions escalate quickly and positions harden creating unspoken rules for deciding who is responsible for any losses incurred. Litigation typically exacerbates the conflict, enhancing the conditions to breed fear, suspicion and anger.

It is often under such a scenario that market solutions, such as water banks, are proposed. Unfortunately, the social dynamics at this point are such that water right holders seldom view water banking as a simple, efficient water allocation tool. Instead, the suggestion, and in fact the tool often is considered by farmers to be suspect. The protection of private property rights inclusive of water right entitlements become the focal point of heated debates between farmers and other potential water users.

How farmers are introduced to the concept of water banking may be as critical as the actual design and operation of the bank. Government intervention which mandates the establishment of water banks to reallocate water for the purpose of resolving a dispute is not likely to garner support of farmers to willingly participate. Farmers are more likely to consider water banks and other market-based solutions if they feel they have some control over the choices made that affect them directly.

How Much Are My Water Rights Worth?

Determining price for water rights leased over the short or long term is a thorny issue that will have to be determined on a case by case basis. As water scarcity evokes more water disputes, a number of policy alternatives may be suggested including water taxes, reductions in existing water allocations, incentive programs to discourage acreages planted in water intensive crops, incentives to increase irrigation efficiency and incentives to temporarily fallow irrigated land. While the concept of voluntarily and temporarily leasing water rights has not been readily accepted in farming areas, the initiative to purchase water rights has gained popularity. In either scenario, farmers and ranchers typically ask about the value of their water rights.

Economists have suggested and tested the premise that a market for water rights exists and is separate from land markets. Tests of this theory have yielded different results, however, and suggest that land and water markets are tied together. In the arid west, when irrigated land is sold the price represents the value of both the land and the associated water right. Typically this price also suggests something about the productivity of
the irrigated land. In fact, studies have indicated that higher water values tend to occur where dry land production is limited due to lack of natural precipitation. In addition, the more productive a unit of water is the higher its value.

As water markets develop to address water scarcity, either in the form of temporary leases or permanent purchases, a fair means of water rights appraisals will be necessary. This should include the valuation of irrigated land in reference to its hydrological characteristics, inclusive of surface water rights (seniority) and flow conditions and groundwater well characteristics (depth and flow).

**Conclusions**

In sum, in western states where water rights typically are already fully or over adjudicated, market-based water transfers can serve as a potential tool to manage scarce water resources. In spite of obvious economic incentives, barriers to the development of water markets are widely documented. Much of the research on barriers focus on third party effects and a perceived threat to water rights as established through Prior Appropriation Doctrine. Additional potential barriers involve hydrologic limitations and potential negative economic externalities. Potential social barriers involve farmers’ reluctance to participate in a solution they may perceive as foisted upon them either through governmental intervention or by special interest groups. Still, market based approaches to water scarcity offer potential alternatives to litigation and should be considered carefully. Research investigating willingness to participate as well various scenarios for the development of centralized institutions to transact short term leases can help stakeholders make more informed decisions at the watershed level.

**References**


