

Colorado River Governance – An Analysis

1. Introduction

The main commons dilemma concerning semi-arid river systems such as the Colorado River is one of severe over-allocation among people who rely on the river. The Law of the River or the Colorado River Compact, 1922 was created for the purpose of providing for the equitable division and apportionment of the use of the waters of the river system and to support the agricultural and industrial infrastructure development in the region.

The paucity of water has resulted in a preference for Prior Appropriation as the legal doctrine of choice. This doctrine states that the first person to take a defined quantity of water for beneficial use, which includes agricultural, industrial or household use, has the right to continue to use that quantity of water for that purpose. Furthermore, in the American West, water use is also subject to prioritization of one use over another giving rise to senior and junior rights holders. There is also massive inefficiency attached to use of water, particularly in agriculture, which is the prime water use category. Farmers who either conserve water or do not use it can stand to forfeit their rights to the water.

Growing populations, increasing demands for water and concerns about future water availability is leading to a growing pressure to reallocate fresh water from historical uses in agriculture, where as much as 80% of water has been used, to meet greater demands in urban areas, recreation and for environmental use (Donohew, 2009; Brewer et al, 2008). Water is a particularly hard resource to allocate than land, due to the fact that it cannot be easily bounded or partitioned across claimants and uses, making it more difficult to define and enforce property boundaries and rights (Brewer et al, 2008).

Traditionally, irrigators have been federally subsidized and furthermore, in the American West, the portion of water devoted to agriculture is applied toward the production of low-valued crops such as hay and alfalfa (Donohew, 2009). This combination of scarcity and low-valued production creates a market for re-allocation of water to higher-valued uses. However, there are numerous barriers to the creation of a water market. Federal agricultural policy, with its massive subsidies, has encouraged the continuing inefficient use of water and has served as a brake on water marketing. Additionally, water infrastructure is also subsidized for low-cost hydroelectric power. In summation, it is necessary to look at available and innovative solutions to allocate limited reserves of freshwater to an ever-growing number of uses and users.

2. Institutional Analysis and Property Rights

Institutions, especially laws and regulatory arrangements, may be used to redistribute income, or be part of rent-seeking activities (Brewer et al., 2008). Various institutional arrangements exist for governing the distribution and allocation of water at different scales. Water governance is complex and the following sections detail the institutional structure at play for river use.

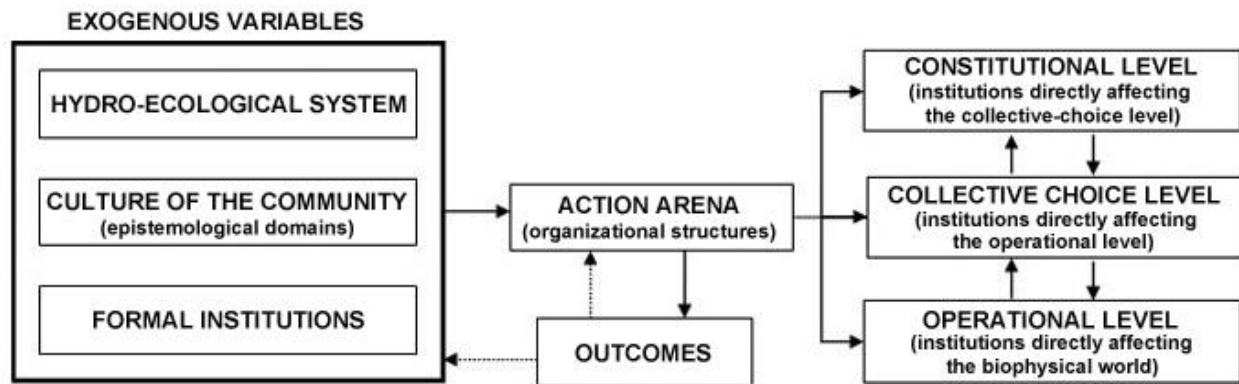


Figure 1: Institutional Analysis of a Hydro-Ecological System. **Source:** Mendez et al (2012).

At the constitutional level are federal agencies such as the Bureau of Reclamation that provide water delivery and infrastructure provision for a multitude of uses. At the collective choice level are state agencies, energy and water companies and irrigation districts that manage allocation of water and energy to users within their domain. At the operational level are the various users and the rights each of these users hold to use water.

2.1 Government Agencies

Federal agencies such as the Bureau of Reclamation act as a wholesale provider of water and manager of critical water infrastructure needed to deliver water to various users who have rights to it. Typically, water rights are held by the Bureau and contracted out to the water districts. Apart from monitoring instream flows and ensuring security of senior rights as well as restricting over-appropriation of water use, the role of state agencies in water transactions is to review applications to ensure third-parties will not be injured and that change in use, time or place, does not ‘enlarge’ the water right (Donohew, 2009). These agencies also restrict duration of leases or transfers of water to predetermined beneficial uses.

Groundwater rights vary across western states and most are not well-defined with few limits on extraction by land owners and no precise recognition in the water rights structure of the interconnectedness between surface and groundwater. The Groundwater Management Act of 1980 defines certain types of groundwater rights and sets the conditions for their exchange. Where rights are not specified, the mobility of groundwater and an inability to adequately observe the size of the resource and level of extraction, together create incentives for competitive withdrawal (Grafton et al., 2011).

Water supply organizations are legally constituted government entities that have the power to tax levies on land and charge for water delivery (Rosen and Sexton, 1993). These organizations include irrigation districts, mutual ditch companies, conservation districts and water companies. Irrigation districts are political subdivisions of the state with substantial powers, including the ability to levy taxes, exercise the power of eminent domain, issue tax free bonds and make rules and regulations for water distribution within the district (Brewer et al., 2007a). These

organizations have complex governance structures and varied voting rights. Within an irrigation district, agreements are set by the district on priority of water rights. Rosen and Sexton (1993) state that substantial intra-organizational conflict can emerge within a water district in response to specific trade proposals. Sales or leases of water between two different irrigation districts usually requires approval of a district board and is usually subject to a certain amount of opposition (Donohew, 2009).

The crux of the conflict is again the nebulous definition of property rights as it applies to water allocation and the resulting ambiguity about the division of financial benefits from water rights transactions. Financing in public water supply organizations may involve both per-unit charges for water deliveries, per acre water availability charges and tax levies on land (Rosen and Sexton, 1993). Irrigation districts obtain most of their revenue from charging water users and the composition of district administration can significantly influence the distribution of water based on how closely the incentives of the administrators aligns or does not align with that of water users in the district.

Public water districts are organized as nonprofit corporations and thus meet the “service at cost principle” which implies that the water district provides service based on the actual financial costs incurred by the district without considering the full social or even the full financial costs of irrigation water (Rosen and Sexton, 1993). Benefits of water use are roughly proportional to the amount of water used. Control in a cooperative is vested in members as users and not as owners, with voting in mutual water companies being in proportion to stock owned wherein stock ownership defines a farmer’s water rights.

2.2 Water Laws and Arbitration

The laws and arbitration surrounding benefits to water users from conserving water are also ambiguous. Brewer et al (2007a) present two contrasting cases, the first one in which the Colorado Supreme Court held that water saved became subject to the appropriation system and could then be used by the next most senior appropriator, as opposed to California, which encourages users to conserve water by giving users the benefit of the water conserved. *Sporhase vs. Nebraska* in the US Supreme Court held that a dormant commerce clause precluded states from prohibiting out-of-state transfers for groundwater. That decision helped pave the way for interstate water sales and federal court challenges to restrict such sales (Brewer et al., 2007a). Due to the inherent conflict in announcing a sale, interstate sales have not really taken off in a significant way.

Other legal instruments exist that enable the regulators to administrate water trade to meet public interest and environmental objectives. Some water trades – especially across catchments or watersheds – can impose environmental costs in terms of stream flow changes and water quality deterioration as measured by salinity, turbidity and other indicators (Grafton et al., 2011). Adherence to the Endangered Species Act (ESA) has been the prime driver for the reallocation of water from agriculture to environmental uses. The ESA specifies imperiled

species and the ecosystems upon which they depend and marks these for protection. Under the ESA, species may be listed as either endangered or threatened and these species are targeted for protection by rebuilding the habitat they depend on.

The ESA has implications for water use as aquatic and riparian species that are listed under the Act result in penalties for water use for those who do not have a “take” permit. The incidental “take” permit allows the use of a resource such as water that may result in the “incidental take” of listed species. A 1982 amendment required permit holders to secure funding for a conservation plan that minimized and mitigated harm to impacted species during a proposed project (USFWS, 2015). The ESA has pushed many river restoration projects in recent years and has required land developers in urban areas as well as water users to provide water to mitigate potential use damage.

2.3 Water Markets

Markets are institutions for achieving reallocation of resources and capital. Water markets have the complex characteristic of being difficult to segment into both simultaneous and sequential use during irrigation. Water use has numerous inefficiencies as well as topological and hydrological aspects that make it difficult to allocate and measure. For water diverted for irrigation purposes, only a part of the water is used, with the remainder percolating back through the ground to aquifers, streams or ditches for repeated access by other parties in the same watershed or basin. In western states, water is owned by the state in trust for its citizens and its use is regulated based on public interest or welfare concepts.

Various costs arise due to bounding water, including migration, setting exclusivity of use, measuring consumption and so on resulting in difficulties in governing water allocation and use as well as reallocation. What makes water a difficult market is the fact that it is simultaneously both a private good and a public good.

Donohew (2009) defines efficient allocation of water in Pareto terms as one that equates the marginal price of water across all uses, net of conveyance costs and adjusting for differences in water quality and priority of water right. The implication is that the marginal price of water is sensitive to how well the water rights are defined between users. Furthermore, reuse of water adds another layer of complexity. Bounding is achieved by assigning water rights to flows of water rather than stocks. Factors that can affect adherence to standard measurement and induce more complexity include the prevalence of seasonality and drought.

3. Discussion and Analysis

Appropriative rights have been useful, in so far as agriculture has been dominant in the western states. Because appropriative rights can be separated from the land and sold or leased, they can form the basis for private water trades. Appropriative rights are measured in terms of diversion, whereas transfers of water that change the point of diversion, timing or nature of use are usually based on the amount of water consumed. This latter method of measurement is

more advantageous in that it protects the rights of subsequent downstream diverters who rely on return flow from the first diversion. Limiting trades to consumptive use reduced third-party effects on downstream diverters (Brewer et al., 2007b). However, increasingly some states such as Arizona are restricting or down-sizing agricultural production and diverting more water toward urban use. This calls for a reform in water allocation and an expansion in how institutional arrangements can support water trading at multiple levels.

Water markets are extremely useful in pushing for allocative efficiencies in water use from low value uses to higher value uses. However, they do have limits including the dependence on infrastructure for conveyance, the lack of which can significantly reduce arbitrage possibilities. This serves to drive up transaction costs. Also, the local nature of water markets arises due to a variety of state regulatory restrictions and associated transportation costs that act as barrier to inter-state water trade. The potential benefits of water markets have also not been fully realized due to a variety of factors as detailed by Grafton et al (2011):

- (1) Incomplete definition of property rights to surface and groundwater.
- (2) Over-allocation of initial water rights in excess of projected water availability.
- (3) Unjustified constraints on trading imposed by local water supply organizations and government.
- (4) A lack of policy coordination across state and federal water agencies.
- (5) Regulatory restrictions on trade including the imposition of fees and charges designed to limit permanent water trade.
- (6) A lack of commitment to water markets in the US and long administrative delays of proposed transfers.

Finally, economic efficiency dictates that water should be allocated to a high-value use. Current agricultural infrastructure supported by government subsidies is not conducive to efficient water use. The quickest way to reform agricultural water use in the United States is to give farmers a financial incentive to use less and to let them sell water to urban users (Brewer et al., 2007a). This would entail significant institutional reform that would enable lowering transaction costs and time and incentivize sale of water to urban users. This institutional reform would need to consider an alternative source of government tax revenue that would enable farmers to leave land fallow or non-profit entities to purchase water rights and secure long-term water leases without penalties.

Furthermore, rural political influence may be lost when large water transfers are made, populations migrate away and there is no clear mechanism for compensation (Grafton et al., 2011). The upside to population consolidation and urbanization is that transaction costs of conveyance and infrastructure can be reduced due to clustering of population in dense urban nodes. Considering the fact that agriculture is highly water-intensive and that the burgeoning populations in the western region of the US would drive a shift of water use away from agriculture and toward urban and environmental uses, this reform needs to happen sooner rather than later.

References

Barnett T., R. Malone, W. Pennell, D. Stammer, B. Semtner and W. Washington (2004). *The Effects of Climate Change on Water Resources in the West: Introduction and Overview*. **Climatic Change** 62: 1-11.

Brewer J., R. Glennon, A. Ker and G. Libecap (2007a). *Transferring water in the American West: 1987-2005*. **University of Michigan Journal of Law Reform**, Vol. 40:4, pp. 1021-1053.

Brewer J., R. Glennon, A. Ker and G. Libecap (2007b). *Water Markets in the West: Prices, Trading and Contractual Forms*. National Bureau of Economic Research (NBER) Working Paper 13002 <<http://www.nber.org/papers/w13002>>.

Brewer J., M. Fleishman, R. Glennon, A. Ker and G. Libecap (2008). *Law and the New Institutional Economics: Water Markets and Legal Change in California, 1987-2005*. **Journal of Law and Policy**, Vol. 26: 183-213.

Donohew, Zachary (2009). *Property rights and western United States water markets*. **The Australian Journal of Agricultural and Resource Economics**, Vol. 53, pp. 85-103.

GRACE Communications Foundation (2015). *The Impact of Climate Change on Water Resources*. Accessed at <<http://www.gracelinks.org/2380/the-impact-of-climate-change-on-water-resources>>

Grafton, R. Quentin, Gary . Libecap, Eric C. Edwards, R.J. O'Brien and Clay Landry (2011). *Comparative Assessment of Water Markets: Insights from the Murray-Darling Basin of Australia and the Western USA*. **Water Policy**, 14(14), 175.

Libecap, Gary (2005). *The Problem of Water*. In **Workshop on New Institutional Economics**, Department of Economics, University of Arizona, Tucson, National Bureau of Economic Research, Hoover Institution.

Mendez, P.F., N. Isendahl, J.M. Amezcaga and L. Santamaria (2012). *Facilitating Transitional Processes in Rigid Institutional Regimes for Water Management and Wetland Conservation: Experience from the Guadalquivir Estuary*. **Ecology and Society**, Vol. 17, No. 1. DOI <<http://dx.doi.org/10.5751/ES-04494-170126>>

Rosen, M. and R. Sexton (1993). *Irrigation districts and water markets: an application of cooperative decision-making theory*. **Land Economics** 69, 39-53.

USFWS, United States Fish and Wildlife Service (2015). *Endangered Species Permits: Habitat Conservation Plans (HCPs) and Incidental Take Permits*. Accessed at <<http://www.fws.gov/midwest/Endangered/permits/hcp/index.html>>