Transaction Costs and Property Rights in the Development of Western Water Law

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# Table of Contents

Introduction 3
Water in the West 3
   Western Water, Externalities, Property Rights and Transaction Costs 3
   Developing Water Rights and Institutions 5
      Pioneer Irrigation 5
   Speculative Reclamation 6
Mutual Irrigation Companies 7
Irrigation Districts 9
   Why Doesn’t Water Move from Agriculture to Urban Uses? 10
   What About Transferring to Environmental Uses? 12
Conclusion 14
Bibliography 15
Introduction

Irrigation is an art. Ask anyone who has plowed a ditch, set irrigation dams, used siphon tubes, changed sprinkler lines, laid drip line, or programmed center pivot systems. Farmers decide individually how best to practice that art depending on experience, terrain, soil type, elevation, available water, temperature, time of year, and type of crop. They skillfully manipulate the timing and amount of water to produce crops with a particular flavor and color and a high sugar or protein content. Farmers can make those decisions only after water is delivered to their fields by irrigation systems—dams, stream diversions, or wells. Water allocation systems and rules (institutions) determine who gets water when, how, and for how long.

This is a story of how water distribution systems and governing institutions affect the use and distribution of agricultural water in the western United States. In most western states, about 75% of the available water is used in agriculture, even though the marginal acre foot of water is often far more valuable in municipal or industrial uses. Transferring water rights from agriculture to urban uses is difficult and costly in time and money. The reason, I argue, is that the rules that successfully created property rights to water and reduced transaction costs for developing agricultural water delivery systems create very high transaction costs for moving water to different uses.

Water in the West

Institutions for managing water in the American West provide several examples of how “government regulation is just one of many approaches that might be taken.” In what follows, I review some history and consider how water institutions emerged to handle the problem of social cost in the late 19th and early 20th centuries, along with how those same institutions may now be getting in the way of solutions to modern challenges.

Western Water, Externalities, Property Rights and Transaction Costs

Early colonizers of the American West faced climate conditions entirely unlike those they had experienced in the eastern half of the country. The semi-arid climate required diverting water to where it could be used, often over long distances. This was especially true for industries like mining and farming, where water was needed far from the only available sources. Farming, for example, could occur only “under the ditch,” meaning downhill from an irrigation canal or ditch.

The system of water rights in the eastern United States was and continues to be the common law doctrine of riparian rights, a system poorly suited to the arid West. Riparian water rights grant the owners of land adjoining bodies of water the right to withdraw water as long as they do not impair the rights of other landowners to use of the same water resource. Riparian land is land
adjacent to a watercourse. Most of the fertile and mining lands in the West were not adjacent to water, however, so the riparian doctrine had to be scrapped in favor of a different system. The system that emerged both in mining camps and farming communities became what is known as the prior appropriation doctrine.

Long before European contact, Native Americans built extensive irrigation networks, but most were abandoned before the Europeans arrived. Some of the Spanish missions developed a few small irrigation joint ventures with Native Americans, usually using pre-existing Native American canals. The first community-scale European systems were built in Utah by the Mormon settlers. On July 23, 1847, a company of pioneers entered the Salt Lake Valley and plowed some land, diverted water from City Creek to irrigate it and planted potatoes. From that initial experiment, irrigation communities developed wherever water was flowing that could be diverted and spread on fields.

The early irrigators faced three institutional problems. The first was developing a system for allocating the available water. That question was addressed first in the mining camps and then in Mormon communities where the doctrine of “first in time, first in right,” was developed. That doctrine remains the cornerstone of Western water law. What first in time, first in right means is that those who first put the water to use had priority access to that water in the future. That priority was, in fact, a property right that became recognized by judicial decree or statute and provided certainty in water resource availability.

A second problem was that downstream users got no water if the upstream user diverted it all for his own use. Prior appropriation solved that problem as well. The senior property right owner had rights to first use. If downstream users wanted water, they had to buy, trade, lease, or rent it from the senior right holder. Given clear property rights assignments and the freedom to trade those rights, no externalities arose, as externalities simply are caused by unclear or poorly developed property rights.

A third problem is the transaction costs of organizing people to cooperate in developing a resource, what to do about free riders, how to deal with opportunistic behavior, and how to match farm size to irrigation system size. Irrigators solved, or at least reduced, that problem by inventing new organizational forms.
The Mormon pioneers developed water codes that became the basis for the prior appropriation doctrine. One early writer explained,

> The Utah pioneers laid down the fundamental principle that since in an arid country the use of water for irrigation is the most important concern of the people, the doctrine of riparian rights must be abrogated, and the proper use of water in irrigation must constitute the fundamental claim of the individual upon the use of the freely flowing waters of the state. This doctrine which now seems axiomatic, represents a great contribution to the conquest of the arid West by irrigation (Widtsoe 1928, 2-3)

A noted above, the Mormons get only partial credit for the prior appropriation doctrine as it also developed at roughly the same time in the gold mining camps. Under prior appropriation, whoever was the first to divert water from a source established the right to keep diverting that same amount of water regardless of whether the flow was high or low. Once the right to first use was established, other users had the right to divert water not already used. The first diverter had a “senior” right and users who came later had legally recognized “junior” rights. An even more extensive ranking of rights eventually was adopted, running from primary or senior rights, to secondary junior and tertiary junior rights. Some rights are based on water that returns to a river after having been diverted by a prior user.

During the early years of irrigation, many thought that the water right was connected to a particular piece of land, and that the only way to purchase a water right was to purchase the land where it was used. It is true that the value of a farm often is determined more by the water right owned by the farmer than by the land itself. But it is also true that water rights now can be bought and sold independently of land ownership. The caveat is that the water rights purchaser not interfere with the rights of other senior and junior users.

The early irrigation systems in Utah and other Western settlements were built cooperatively. After identifying potential dam and diversion sites, the dams and ditches were built by the people who were to use the water. John A. Widtsoe, who assisted in forming the College of Biology and Agriculture at Brigham Young University and then was President of Utah State University and then

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1 Being able to separate water rights from land rights was not always the case. In Utah, for example, water could not be sold separately from land until 1880, when the territorial legislature passed “An Act for Recording Vested Rights to the Use of Water and Regulating their Exercise.” The law allowed individual users to buy and sell water rights. In addition, most of the shares of common stock issued by the early mutual irrigation companies were considered appurtenant to the land irrigated by those shares of water.
the University of Utah, wrote about those early efforts,

Such cooperative efforts fit the nature of irrigation itself, for, after a ditch has been built, its maintenance becomes the joint concern of all who use water from it. Pioneer reclamation is always cooperative reclamation. The principles recognized, the rules and regulations set up and the cooperative spirit developed made it possible to create under the ditch, in full accord with the American spirit, a civilization conforming to the best knowledge and thought of the day (Widtsoe 1928, 3).

Utah’s pioneer irrigation efforts were so extensive that by 1865, seventeen years after arriving in the Salt Lake Valley, they had dug 277 canals, 1044 miles in length, at a cost, including the cost of dams of $1,766,959;2 by which 155,949 acres were irrigated, at an average cost per acre of not quite $12;3 and the estimated cost of canals in progress was $877,730 (Widtsoe 1928, 4).

**Speculative Reclamation**

The pioneers developed the easiest projects first and were so successful that irrigation in the West soon attracted capital from Eastern investors. The era of speculative reclamation (to use Widtsoe’s phrase) was quite different in that the projects were more expensive, were not built as cooperative efforts, water users did not own the infrastructure, and interest on crops irrigated went to a capitalist-builder, not a farmer-builder who farmed under the ditch. Those ventures failed more often than not. The investors had little local knowledge about the harsh realities of the arid West and project owners were too distant from the water users. Because the water users did not own the infrastructure, they had little incentive to maintain it. Developing water projects in the more difficult places was more expensive than investors had expected and the per acre cost rose more and more, which drove capital in other directions. In addition, some commercial companies tried covering the rising costs by charging higher and higher fees. Bretson and Hill cite an observer who noted that commercial irrigation companies could sell land under the ditch, wait while farmers improved their farms, refuse to deliver water when crops needed it, take over the farms when farmers could not make payments, and then resell to other farmers (Bretson 2006, 300). Farmers responded by refusing to buy water and went to their state legislatures for relief; several states passed laws regulating the sale of water rights by commercial irrigation companies.4

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4 A central part of Wallace Stegner’s novel, *Angle of Repose*, has to do with the enthusiasm for and then failure of a commercial irrigation company.
**Mutual Irrigation Companies**

The main transaction cost problem for irrigation is that farms require being a certain size to capture economies of scale, but irrigation infrastructure must be on a larger scale to serve multiple farms. That is, irrigation presents a collective action problem. Getting the farmers or potential farmers together to create the infrastructure was accomplished in pioneer times by cooperative reclamation. Commercial irrigation companies built a lot of infrastructure, but many failed. They gradually were taken over by local mutual irrigation companies. In an effort to overcome the free-rider problems that came with funding and building irrigation infrastructure, farmers formed mutual irrigation companies to construct, maintain, and manage that infrastructure. Bretson and Hill argue that mutual irrigation companies were successful at “reducing or eliminating transaction costs in areas where the commercial irrigation company had failed” (Bretson 2006, 302).

Mutual irrigation companies acquired appropriative water rights, either from other companies or from the members of the association and redefined those rights as shares.

The concept of shares in a flow rather than a senior or junior right was another innovation in Western water law. When farmers joined a mutual association, they no longer owned a property right; the right to divert water was owned by the association. What the farmers owned was a share of the flow of the association’s water right. The concept of shares solved the conflict between senior and junior rights holders as no one was senior or junior. They each had a right to a share of the water right owned collectively by the association. The shares were allocated by time of water use. My shares of the Spring Creek Irrigation Company, for example, identify the time each week that my access to water starts and stops. The next person below me on the ditch has the next turn and so on all the way to the end of the ditch.

The mutual irrigation companies, as well as the pioneer organizations, faced a free-rider problem over the operation and maintenance of irrigation. Being one of the people at the head of the ditch meant there was little or no incentive to worry about users further down the ditch. Why should water users, for example, be concerned about the status of the ditch beyond the boundary of their farm? Even if the ditch below them fails for lack of maintenance or any other reason, they will still get their water. Another problem is that those at the head of the ditch could not be relied on not to steal some water as it flowed past.

Bretson and Hill cite Elwood Mead, Wyoming Territorial and State Engineer for in the late nineteenth century and the head of the head of the USDA Office of Irrigation Investigations, 1898-1907. He helped structure Wyoming’s water code and federal irrigation legislation. He noted:

> Enthusiasm or the press of need would suffice to build partnership ditches, but friction
would disrupt their subsequent operation. Human selfishness would then assert itself. The man whose land was near the ditch did not need to keep it in repair; so long as water for others had run past his lateral, the people below him would have to attend to this or do without. The irrigator having this fortunate location showed equal ingenuity in manipulating his head gates so as to take more than his share of the water, while the unfortunate irrigator at the lower end of the ditch found himself doing more work and getting less for it than the other members of the partnership. Until farmers learned that they must place the control of the ditch in the hands of one individual, there was either murder or suicide in the heart of every member of the partnership (Bretson 2006, 311-312).

The Mormon pioneer irrigators addressed the free rider problem ecclesiastically. As Mormon historian Leonard Arrington writes in *Great Basin Kingdom*:

> When a group of families found themselves in need of water (or additional water) to irrigate their farms and gardens, the bishop [the local religious leader] arranged for a survey and organized the men into a construction crew. Each man was required to furnish labor in proportion to the amount of land he had to water. Upon completion of the project the water would be distributed by a ward watermaster in proportion to the labor. The labor necessary to keep the canal in good repair was handled in the same way, in accordance with assignments made in regular Sunday services (Arrington 1958, 53).

Mutual irrigation associations did not have ecclesiastical authority, but they addressed free riders by hiring a watermaster, whose job was to patrol the ditch and manage conflict. And conflict is real. In 1966 my father owned a 400-acre farm at the end of an irrigation ditch. We went out one morning to change sprinklers and none of them were turning. We drove up the hill to the reservoir and found it empty; no water was flowing in the ditch. But we could see upstream that sprinklers were active. It turned out that the ditch had broken between us and upstream users. Arguments became heated, but the irrigation company chose three men to walk the ditch for the next twenty-four hours while a backhoe operator repaired the break. In the meantime, upstream users had to reduce their withdrawals so a small stream could get by the break and serve those of us downstream. The three men, including my father and the watermaster, patrolled the ditch with shotguns! No one even considered calling the county sheriff. The problem was internal to the company and they handled it. There is a lot of truth to the statement, “In the West, whisky is for drinking, water is for fighting.”

Some people wonder why a small group of farmers cannot cooperate without a watermaster to
enforce their rules. It turns out that any sustainable system for managing a common pool re-
source requires a means of enforcing the agreed upon rules. Elinor Ostrom studied successful
common-pool resource management across the world and found eight common traits, which she
called design principles. Her fifth principle is “Develop a system, carried out by community mem-
bers, for monitoring members’ behavior (Ostrom 1990). My own experience is anecdotal but
mirrors Ostrom’s findings. My city (Providence, Utah) is the majority owner of shares in a water
channel that passes through a neighboring town of about 5000 people. While I was mayor, only a
small amount of water was reaching my city. I contacted the ditch company president and asked
why. His response was that they had not hired a watermaster for the other city and people were
just opening their head gates whenever they wanted, not when it was their turn. As soon as the
city hired a watermaster, our share of the water reached us.

Because everyone who owns shares in the company is assessed an annual fee, the problem of up-
stream users not paying for downstream maintenance and improvements is solved. The fee also
covers the costs of the watermaster. Decisions are made at an annual meeting where corporation
officers are chosen. With the company owning all the water rights, no cost is imposed on junior
users by senior users. Everyone has a right to a share of the flow. Thus, in low water years, even
those at the end of the ditch get their share of the low flow. The companies are formed under the
laws of the state, but are, for the most part, self-governing.

Mutual irrigation companies all have some features in common: they are voluntary organiza-
tions; they make cooperation possible by establishing collective decision-making mechanisms;
they place the ownership of the irrigation works in the hands of a single entity that serves several
farms; and the farmers own shares in the water right, which was owned by the company.5

Irrigation Districts

Towards the beginning of the 20th century, irrigators began to form new, larger, public/private
organizations, known as irrigation districts. Irrigation districts had many of the features
of mutual irrigation companies, but states granted them added powers that included “eminent
domain, the power of taxation, the power to issue bonds, and exemptions from state and federal
income taxes” (Bretson 2006, 316). As the federal Bureau of Reclamation began constructing
large irrigation projects, including dams and pipelines, it contracted with irrigation districts who
gained exclusive distribution rights to the Bureau’s water. Today, irrigation districts deliver water
to both individual water users and to irrigation companies who then reallocate the water to their
members.5

5 Remember that, according to each Western state’s constitution, the state owns the water. Water rights are
usufructuary rights—rights to use the water.
Transaction costs are reduced even more by irrigation districts than by mutual irrigation companies because the districts have the police power of the state behind them. They can condemn private property in order to build a canal across land, so they are not subject to holdout problems.\(^6\) They are not voluntary since, although state laws vary about the sizes of the required majority, a vote by a majority of landowners forces all landowners within a district’s boundaries to join, and they can issue bonds backed by assessments of the district’s land values. Like mutual irrigation districts, they provide a way to make collective decisions and to enforce those decisions.

Irrigation districts are a far cry from the initial pioneer ditch companies or the mutual irrigation association in which I own shares. They control vast amounts of water. The Imperial Irrigation District in Southern California, for example, annually diverts 2.5 million acre feet of water from the Colorado River (nearly two-thirds of California’s legal share), serves over 5000 farms totaling 520,000 acres, and has more than 3000 miles of canals and drains in an area that receives just three inches of rainfall per year (“About IID Water”). Besides becoming powerful economic interests, irrigation districts have become powerful political interests, lobbying state legislatures for, among other things, more taxing powers.

*Why doesn’t water move from agriculture to urban uses?*

The water management institutions that developed, based on clear property rights and reducing transaction costs, have made it very difficult to transfer water from one use to another even when the marginal value of water to agriculture is far below its value for municipal or environmental uses. The irony is that transaction costs, which were reduced for irrigators trading within a company, are very high for trading from agriculture to municipal or industrial uses. Majoritarian decision rules keep farmers from contracting individually outside the association. Owning a share in a water company or association does not include the right to sell or transfer one’s shares to non-members. If one’s share of a water right is in an association involved with the Bureau of Reclamation, the transaction costs of moving water across uses are even more difficult.

Irrigation institutions were not organized to transfer water for uses outside the mutual association or the district. Their purpose was and continues to be entirely internal. Water share markets are active within mutual associations and districts, but little trading takes place outside the district. I, for example, own 3 ½ shares in Spring Creek Water Company, a mutual irrigation company. I recently purchased 2 of those shares from a fellow company member. The company then adjusted the times at which I access those shares in order not to adversely affect downstream users who

\(^6\) Courts have decided that this exercise of eminent domain is not an unconstitutional 5th or 14th Amendment taking because irrigation is a public purpose.
need “carry water” in the ditch to make sure they receive their full shares. I did not contact the water company, the state, or anyone else about whether or not I could purchase those shares. The previous owner and I just agreed on a price and he signed his share certificates saying he had sold them to me. Our ditch also has an active informal system for trading rights and sharing excess water that does not need to be approved by anyone but ourselves. But, if I wanted to sell my shares to someone who would use them outside our company, the process would be difficult. The board of directors would have to agree. The state water engineer would have to approve the sale. Other interested parties could appeal the sale; the rules for being an interested party are extremely lax.

The process for transforming an irrigation right into a municipal right can be Byzantine. While I was mayor, we (the city) purchased water rights from an individual whose point of diversion was 15 miles away on a source that did not flow even close to our city. The purchase was not from someone owning shares in a mutual or irrigation company, so we did not have to get the board of directors’ approval. The right was a tertiary right, so it was very junior. We applied to the state engineer to transfer the point of diversion from its historical site to a new well we would develop in our city. The engineer approved and the appeals started.Transferring the right cost thousands of dollars in attorney fees, engineering witness fees, fees for expert witnesses who presented data about the effects on downstream users (in our case aquifer users) and took two years. What might have been a simple exchange became a long, contentious process. After going to the state’s First District Court twice and holding numerous hearings we finally made the purchase. The focus of the review by the state water engineer was to ensure that no other water rights were injured by the transaction. He decided that no one would be harmed. We had to go to court because other interested parties disagreed. See Table 1 for a description of the process.
Some of the difficulties of moving water from agriculture are illustrated by the lengthy process involving the Imperial Irrigation District and the Metropolitan Water District of Southern California. Negotiations began for long-term water leases in 1984, and concluded in 2003. Agreements were reached during that time, but collapsed after challenges by opponents. The U.S. Department of the Interior, which administers Colorado River water, intervened and a transfer of 30 million million-acre feet to urban users over 75 years finally was agreed to. The initial plan was to idle some agricultural lands, but opposition was so intense that the final agreement was that water for the transfer would be provided by lining ditches to reduce seepage, even though it is likely that following would have been cheaper.

Prior appropriation is partially at fault for the difficulty of transferring water across alternative uses. Because the property rights are for specific amounts of water, junior rights holders are likely to be harmed if the senior rights holders sell their rights. Thus, junior rights holders are likely to protest and litigate. If, however, rights were specified as shares of the annual flow, then junior rights holders would be protected.

What about transferring to environmental uses?

Transferring water from agricultural uses to environmental uses faces the same difficulties as transferring it to urban uses. The water management institutions that served the development of agriculture so well get in the way of seemingly simple trades. Again, the problem is one of externalities and transaction costs.
A dewatered streambed would seem to qualify as an externality demanding government intervention. A Coascean perspective might be to ask who owns the water right, the fish that will be killed if the stream is dewatered or the farmer. It turns out that fish do not own water rights, farmers do, but only if they divert water from the stream. The farmers’ appropriative right may allow them to divert the entire stream, leaving the fish and other aquatic species high and dry, literally. Given that the right to divert is clear, it ought to be relatively simple for friends of fish to purchase some of the diversion rights and leave the water in the stream. The problem is that under the prior appropriation doctrine and state legislation, water has to be diverted in order for a property right to exist and be enforced. Water rights are only for “beneficial uses,” as defined by state law; until relatively recently, leaving water in the stream was not considered to be a beneficial use in most Western states.

Beneficial use was intended to prevent wasteful water use by requiring that all diverted water is used in a beneficial way. If appropriators fail to put water to such use, the state can revoke the water right. Utah’s statute is typical: “[W]hen an appropriator or the appropriator’s successor in interest abandons or ceases to use all or a portion of a water right for a period of seven years, the water right or the unused portion of that water right is subject to forfeiture....” (Utah Code).

Water rights owners must put their appropriated allocation of water to beneficial use, or risk forfeiting all or a portion of that right to the state or to those with junior rights. The beneficial use doctrine discourages conservation because it slows the discovery of new beneficial uses and forces water rights owners to use their full share of water or lose their right without compensation.

Commonly accepted beneficial uses include agriculture, industry, domestic use, and recreation, but do not include uses like conservation or instream flows, which is leaving water in the stream rather than diverting it. Utah water law, for example, “allows for current water rights to be converted to an instream flow only by the Division of Wildlife Resources or the Division of Parks, Lands and Recreation.”

Over the last 25 years, most western states have legally recognized instream flows as a beneficial use, but with significant diversity in implementation. Thus, large differences exist between states in allowing the sale or lease of appropriative rights for instream uses. Oregon and Washington have approved hundreds of leases and other transfers, while Wyoming, Arizona, and New Mexico have approved almost none.

Montana’s chapter of Trout Unlimited has an impressive record of converting water rights to instream flows whether through purchase or lease. As might be expected, given that only selected state agencies can own an instream flow in Utah, the Utah Trout Unlimited chapter has not
had similar success. The transaction costs of working around the state’s rules are very high. They have had, however, one significant success on the headwaters of the Bear River, a 350-mile-long river that starts in the Uinta Mountains in Utah, travels through parts of Wyoming, Idaho, and Utah, and empties into the Great Salt Lake. Two different irrigation companies own rights to divert water near the river’s headwaters. Until recently, each spring the companies hired a D9 Caterpillar to drive up 15 miles of streambed and create a “push-up dam at the diversion point. The dam completely dewatered the next several miles until smaller streams joined the streambed. Utah’s chapter of Trout Unlimited spent three years negotiating with the irrigation companies and the state to move the diversion point of the irrigation water several miles downstream and build new distribution canals. Changing the diversion point meant more water in the river than at the previous diversion point, meaning that the irrigation companies could not take all of the water and dewater the river. Trout Unlimited successfully raised the money, got the blessing from the state water engineer, and reached agreement with the canal companies. They had to develop such a roundabout way to get an instream flow because they were not allowed to purchase and hold an instream flow outright under Utah’s beneficial use rules.

Conclusion

I started by asserting that irrigation is an art. Designing institution also is an art, but it is one that few are able to master. That is probably why the best institutions often are those that emerge from human experiences as opposed to being created consciously. The prior appropriation doctrine and the organizations that developed to manage water and water users are ones that emerged in the American West.

Water rights in the American West (by and large) are clear. They are not fee simple rights, but are usufructuary, meaning that they represent rights to use water, but the state retains ownership of the water. Emerging out of mining camps and pioneer irrigation experiments, the use rights are well established, recognized by the states, courts, and even banks. Where extensive irrigation infrastructure was required to move water to irrigable lands, irrigators developed ways to minimize transaction costs by creating mutual irrigation companies and irrigation districts.

Those same institutions, however, make transferring water across alternative uses difficult. That is, they create transaction costs and rules that get in the way of potential markets in water. Sometimes people can find clever, if costly, ways around the existing system, as did the Utah chapter of Trout Unlimited. At other times and in other places, the process is so drawn out and complicated that a central authority is needed to break the logjam, as was the case of the Imperial Irrigation District.
Bibliography


