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Designing property rights for water: mediating market, government, and corporation failures

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Abstract Recent decades have seen an acceleration in public concern about the allocation of increasingly scarce water supplies. There are many reasons for this concern, such as growth in urban populations. In this article, we focus on how surface water's special qualities (the combination of spillovers, rent-seeking behavior, and common pool resources) complicate the assignment of property rights in any legal framework. These characteristics make specific market structures necessary in order to efficiently allocate rights. The state usually designs those structures. Yet, just like markets can fail, so can governments fail to effectively allocate those rights. So designers often turn to quasi-judicial conservancy boards as a second-best solution. We argue that those boards may themselves fail through a form of "corporation failure." We address these three types of failures, and offer an analysis of two cases that suggests that the likelihood conservancy boards will suffer from corporate failure depends on the actions of the boards and outside stakeholders (like governments).

Keywords Water rights · Institutional design · Second best solutions · Market failure · Government failure · Corporation failure · Double moral hazard

Conventional reasoning in economics holds that the market allocates scarce resources so that their individual marginal products are equal for all of the different possible uses; in equimarginal valuation the marginal cost of that resource is equal to the value of its marginal product in every use. When resources are nonexclusive or "common pool", uncaptured costs, which are not accounted for in exchange or use, complicate true

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equimarginal valuation. People using these kinds of resources have little reason to do what canonical theory says they should do: maximize the present value of total extractions over time. Essentially, a person who tries to conserve a resource by not removing it recognizes what they are doing is really abandoning it, so they extract the resources until they are satisfied. If everyone acts the same way, they will collectively extract the resource at a rate greater than its sustainable yield, resulting in its eventual exhaustion. In addition, any person who "over-extracts" increases the marginal extraction costs of all others, just like people who face congestion costs in public goods like roads.

In turn, the public and others often demand that the state intervene in markets that produce these kinds of suboptimal results. Of course, there are many ways policy designers can limit the damage, including using coercion, changing the incentives, and appealing for self-restraint. Designers have conventionally argued the need for public management of common pool resources for technological reasons if we want to maximize efficiency and equity:

> It is the clear duty of the Government, which is the trustee for unborn generations as well as its present citizens, to watch over, and if need be, by legislative enactment to defend the exhaustible natural resources from rash and reckless exploitation.[1]

Is it that natural resources are inherently different from other assets—or are they just scarce? This perception of the "nature" of natural resources helps us understand how designers see the need for solutions to the extraction problem. Indeed, the ability to regulate most common pool resources depends on how perceptions help us coordinate our actions (e.g., Ostrom 1990).

The first purpose of this article is to illustrate design dilemmas that come about in the case of the regulation of surface water because of the special combination of spillovers, rent-seeking behavior, and common pool resources. To be specific, because supplies of surface water are often nonexclusive, our solutions are the "result of rationing transactions by units of government rather than bargaining transactions in the market place" (Huffman 1953, p. 37) (or pure markets for exchanging rights to surface water). The institutions we use to do this vary across the United States, with riparian rights doctrines in the east, appropriative or prior appropriation rights in many states west of the Mississippi Valley, and a hybrid system of water rights on the Pacific Coast and in the High Plains states[2] Rapid development during the 1950s brought with it water shortages, so conventional wisdom came to see water supply as a critical resource and attention shifted toward expanding supply. Over time, economists drawing on experience gained in the analytical evaluation of water projects suggested that the main issue was not physical shortage, but instead a need for optimal allocation and efficiency in expanding supply. We came to see a defective institutional framework that suboptimally determines ownership as the crux of the problem (Milliman 1962; Ciriacy-Wantrup 1956, Coase 1960). The problem became one of finding of an appropriate institutional framework that allowed markets to work, obviating the need for government to allocate. Different solutions were developed to mitigate third-party effects particularly during drought periods, such as the cooperative pooling of water resources, water rental or banking systems, and the cooperative storage of water (Howe et al. 1982).

[1] Pigou, quoted in Milliman (1962, p. 199).

[2] The following are hybrid states: California, Kansas, Nebraska, North Dakota, South Dakota, Oklahoma, Oregon, Texas, and Washington.

These innovations provided new and useful data about how institutions frame the choices of individuals. For example, we now recognize that cooperative pooling works well in small watersheds where there are only a few users, but breaks down when there are more than five or six; when they do work, in order to allocate water to the highest marginal value they must take away some users' absolute extractive rights. We understand that while water rental or banking systems have some of the efficiencies seen in cooperative pooling, they often falter from traditional market failures (Howe et al. 1982). Cooperative storage (the use of a reservoir to store and minimize water loss) often suffers from both market and government failure in times of scarcity, since the ownership of rights to the pool usually involves complex contracting and conflicting claims. While in general, "changes in property rights are triggered by the interaction between the prevailing property rights structure and man's search for ways of achieving more utility" (Furbotn et al. 1974, p. 3), these solutions show how water's special qualities complicate the assignment of water rights in any legal framework. Designers have sought structures that help markets efficiently allocate those rights. Since the state designs these structures, two problems—market and government failure—make it difficult to assign property rights to water.

As a result, one solution has been to use quasi-judicial conservancy boards as a means of regulatory power. These boards are like governments in that they can oblige conditions about the allocation of water, something markets can only do through incentives; for example, a board might require in a contract of sale that a user use drip irrigation or similar technologies in agricultural applications. Likewise, conservancy boards are like markets in that they can contract based on the highest marginal use, which would prompt conservation efforts by users to assure continuing allocation (Howe et al. 1982).

The second purpose of this article is to investigate the degree to which these boards fail in the same way as markets and governments through a special form of "corporation failure." By corporation failure we mean that the problems of market and government failure are replaced with a new difficulty: *monitoring the monitors* (the so-called "double moral hazard" problem). We offer case-level evidence analysis of these boards that suggests that corporation failure can be a real and important force in the performance of these boards, that boards and stakeholders recognize that possibility, and that in response boards and stakeholders (especially, governments) construct defenses against that failure. Together, these dilemmas indicate that legal, economic, and scientific solutions cannot uniquely combine to overcome basic "political" problems in the formation of stable and efficient property rights.

Our article proceeds as follows. In the next section, we briefly overview these traditional institutional structures for allocating property rights to water, and identify dilemmas resulting from this combination of special characteristics, institutions, and design choices. In the third section, we turn to the issues of market and government failure in water property rights. In the fourth section, we move from market and government failure to the use of boards; we also argue that corporation failure can haunt these kinds of authorities. Next, we present two cases in which quasi-judicial conservancy districts are used to examine the evidence on corporation failure. Finally, we briefly discuss these dilemmas and the difficulty of finding solutions to the problem of allocating water rights.

Historical views on property rights for water

We begin with a short description of how and why water has been regulated as a special resource in the U.S. Generally speaking, water supplies fall into two hydrological classes:

either definite and indefinite in its form and where it occurs (Wiel 1911, p. 1). By "definite" we mean bodies of water that have a permanent presence or flow and have defined banks (typically permanent rivers, streams, lakes, and ponds); "indefinite" means those are not permanent and lack defined boundaries (e.g., seasonal rivers and lakes). The U.S. is really two distinct hydrologic countries (the wet east and the dry west), which has brought about different frameworks for governing water rights. In the east, the doctrine of riparian rights gives to owners of land bordering a body of water usufructuary rights (or rights to use) to that water, implying only use, not ownership of the water itself (Ferry 2004, p. 261).[3] These rights are limited to reasonable use, a standard that is governed by the states themselves (Kubasek and Silverman 2005, p. 224).

The doctrine of appropriation governs water use in the western U.S.: "first in time means first in right" (Milliman 1959, p. 43). Historically, in these systems the first user to withdraw water from a watercourse was limited in the amount of water that could be withdrawn only by the capacity of the canal she constructed (Wiel 1914). Appropriative systems, which were designed by mining companies during the California gold rush and spread later to other parts of the West, grant specific rights to the first appropriator of the water (Anderson and Hill 1975, pp. 177–178). These include: exclusive rights to water for the appropriator; the right to divert water to non-riparian lands; the loss of rights (i.e., forfeiture) when the appropriator does not use the water; and, the ability to transfer rights in the market. As it now stands, the doctrine assigns exclusive rights to the first appropriator and to junior (or inferior) rights holders thereafter (Kubasek and Silverman 2005, p. 225). Continuation of those rights is contingent on making beneficial use of the water (Huffman 1953, p. 43). Yet, despite the prioritization of original users in the system, the state retains ultimate ownership of the body of water, so rights are essentially usufructuary (just as in riparian rights system used in the eastern U.S.) (Anderson 1983a, p. 41). In general, priorities are based on the use of water, with domestic uses typically given highest priority, followed by agriculture and industry. This system, in its pure form, creates incentives for non-conservation because "[a]ppropriative rights are established because of demonstrated needs; without this need, the legal right for future use is replaced by the rights of [other] current users" (Kubasek and Silverman 2005, p. 225).

Over time, some states developed hybrid systems of water allocation by mixing riparian and appropriative systems within the same state. For example, California, with its numerous hydrological regions, developed a riparian system in the wetter northern portion of the state, appropriative rights systems in the dryer areas, and an overlap of the two in-between. Other states created overlapping systems throughout the entire state. These examples show that the development of these different systems often varies with the relative scarcity of water.

Interestingly, designers have long struggled with how society treats the "uniqueness" of water. Of course, the fact that human development depends on the availability of water does not prove uniqueness—both food and oxygen are also necessary for survival. Some argue that those perceptions of uniqueness depend on romantic notions that water can make "the desert bloom like a rose" (Hirshliefer et al. 1960, p. 4). Probably just as important are widely held beliefs that societies need water to develop. For example, in southern California water policy meant for many years that the waters of Owens Valley and other areas were allocated to urban areas via the appropriation. While in recent decades competing demands shifted that allocation, greater conservation efforts have actually provided the region (at least temporarily) with the water it needed for even more growth (Haddad 2000).

[3] We note that riparian rights can be sold to a non-riparian landowner (Ferry 2004, p. 260).

We want to emphasize here that institutional frameworks for water rights, in their varying forms, are encompassed within a broad theory of property rights. This theory, proposed and elucidated by economists like Coase, Demsetz, and Alchian, argues that "individuals respond to economic incentives, and the pattern of incentives present at any time is influenced by the prevailing property rights structure" (Furbotn et al. 1974, p. 1). A scheme of well-defined property rights actually relies on two assumptions about human behavior. First, individual choices will reflect equimarginal valuation (the marginal products will be equal for alternative uses). Second, the choices a person considers at a point in time depend on prior, prevailing, or expected rights structures. Essentially, property rights are "sanctioned behavioral relations" among actual and potential transactors (Furborn et al. 1974, p. 3). There is a framework for rights, that framework depends on how we think about the choices people consider and make, and it evolves through time.

In a system of well-defined property rights, an "owner" can use an asset, expropriate returns from the asset, change the asset's form and/or substance, and exchange the asset for another. Most traditional frameworks for the assignment of water rights include the first two, omit the third, and are limited in the degree to which they provide for the fourth. A property right for water is for its use, not its physical long-term ownership. For example, water usually must be returned to its source upon use (either through irrigation or treatment in residential or industrial uses), and in a riparian rights system, its use must not diminish the use of other, downstream landowners. These kinds of omissions lead to a deficient rights structure and the suboptimal results that designers worry about when considering how to allocate water and balance the roles of the market and the state.

The state attenuates rights to assets, and that attenuation restricts the quality and quantity of choices that are available to individuals—and shapes their expectations about the choices they will face in the future. In the case of water, rights are affected on two primary dimensions: security of supply, and flexibility (for example, rights of exchange). Security of property rights to water means protection from uncertainty—legal uncertainty, physical uncertainty (variability over time and conditions), and tenure uncertainty (variability over time due to the legal acts of others) (Ciriacy-Wantrup 1952, 1956, 1967). States with appropriative systems usually have statutes on what uses are considered "beneficial" and how much a user can extract from a source (Kubasek and Silverman 2005, p. 227). These rules often subject water rights to condemnation, which provides little reason for people to maximize their net present value of extractions or to initiate capital-intensive investments. Uncertainty has economic effects—for example, legal uncertainty amplifies relationships between users and how they relate in the market, causes water supply to vary over time, and changes the state of demand (Tolley 1965, p. 280). To mitigate these uncertainties, designers are left with changing other institutions, like those relating to tenancy, credit, or taxation. This uncertainty, especially when demand patterns depend on how people relate to one another, provides a rationale for design solutions like adding storage capacity (Bower 1965).

Legal flexibility refers to the range and types of choices the user of the water resource is permitted, as determined by both statutory law and case law. Statutory law often restricts the transfer of rights; case law limits the use of the right in situ. Importantly, the amount of flexibility determines how users can resolve legal uncertainty; essentially, "legal uncertainty may be regarded as the price that must be paid for obtaining legal flexibility" (Ciriacy-Wantrup 1967, p. 427). In designing water systems, increasing flexibility in water transfers or uses in situ increases uncertainty for other users (in the form of physical shortages, etc.), so adding flexibility contributes to third-party effects. One reason for these diseconomies is the absence of a clear right to contract (Cheung 1974, p. 11). We would

like for a contract to provide for the partial or total transfer of the owner's property rights, specify how income is distributed among the participants, and lay out the conditions for use of the resource. In market exchanges, the full assignment of property rights helps individuals achieve equimarginal valuation if there are zero transaction or coordination costs (Demsetz 1974, p. 32). When owners cannot contract or contracts are incomplete, equimarginal valuation fails. A lack of legal flexibility (especially with regard to the right of transfer) leads to overuse of the resource and higher enforcement costs.

The way these rights systems have evolved over time in the U.S. and similar countries complicates the problem of designing water allocation systems. First, these frameworks restrict the changes that owners can make to the resource's form and substance. Second, owners' rights to surface water are particularly susceptible to legal, physical, and tenure uncertainty. Finally, in an environment with high transaction costs and imperfect information individuals cannot easily compensate one another through bargaining or negotiation for the external effects of their actions. The designers of allocation systems for surface water systems are left with identifying ways around these features.

When governments and markets fail

Part of our argument is that markets for surface water fail in part because of how the legal system helps define those rights; that while some economic uncertainty flows from the nature of the resource, much of the economic uncertainty comes from how the legal system has (in different ways and in different places) balanced legal flexibility and legal certainty. We now turn to the related problem of government failure (i.e., Wolf 1979; LeGrand 1991; Datta-Chaudhuri 1990), which is different from externalities in that government defines the institutional structure within which allocation takes place. Of course, the problem of government failure is partially a problem in welfare economics. Government's coercive power often leads to the negative-sum game of rent-seeking, an outcome in which decision-makers in government maximize their own utility. We emphasize that collective action problems are naturally difficult in the case of surface water (e.g., Ostrom 1990), but that for a number of reasons government also may make it difficult to achieve the kind of efficient resource allocation that many designers want for water. For example, in water policy voter ignorance and imperfect information allow the concentration of benefits and the diffusion of costs. This policy area is usually dominated by special interests with incentives to expropriate available benefits. Politicians with short political terms downgrade intertemporal equity in favor of the present time period. Collective institutions are rarely internally efficient, a situation made even more difficult in the case of water policy. And political goods are usually "bundled" and so often do not accurately reflect voter preferences (Anderson 1983b, p. 5). These kinds of government failures have pushed designers away from pure communal stewardship regimes for common pool resources, if only because the allocation of water by the government is fraught with negotiation, enforcement, and congestion costs. These costs explode largely with free-riding and intertemporal imbalances in the distribution of costs and benefits.

In practice, the move away from rights to permits for the use of surface water has been due to perceptions about government failure, just as prohibitions on market transfers are linked to perceptions about the market failures mentioned earlier. Perceptions are often rooted in reality, for such institutions offer profit for some users at the expense of efficient allocation. For example, in Arizona farmers paid \$3–\$10 per acre-foot of water, while cities paid \$100–\$120 for that same amount of water (Haddad 2000, p. 10). In the end,

much surface water is "effectively withdrawn from commerce in a mortmain grip as deadly as that fastened on the lands of medieval Europe" (Mason Gaffney, as quoted by Alfred Cuzan 1983, p. 23).

But in market failure, rent creation (a positive-sum game) falls apart if the full benefits or full costs are not realized. In riparian rights systems, upstream users may diminish neither the quality nor quantity of water—each must work to preserve the water source. While landowners can divert water if it does not interfere with the legitimate use of other rights holders, the states "individually determine *reasonable use*" (Kubasek and Silverman 2005, p. 224 emphasis added). A state that fails to optimally enforce the assignment of rights of use gives people more reason to over-extract and makes it likely that resources will not reach their highest valued use. In prior appropriation systems, externalities will depend on how states regulate beneficial use and the amount of water that owners can divert. If the enforcement or allocation agency defines rights as the optimal distribution of preferences and beneficial uses, all the social costs would be internalized and the first best outcome would be the result.

For example, consider the impact of the allocation framework on the likelihood that market exchanges of rights affect other users. For efficient allocation in the case of two extraction points on a stream, the marginal product at the downstream location must be greater than the marginal product at the upstream location by the reciprocal of the consumptive use downstream (Hartman and Seastone 1970, p. 9). Yet, increased demand (consumption) affects the marginal products of downstream extractors. Demand expansion should lead to the transfer of rights in the market. In practice, in an appropriative system the maximum amount that can be transferred is the historic amount of consumptive use. Riparian systems allow for transfers of the "reasonable use" of water, a limitation set by statute in each state (Ferry 2004). In both systems, transfers of rights will change the return flow pattern, affecting nearby users, if the right is transferred to someone distant from the original owner. As a solution, return flows could be sold while accounting for past and expected use of the water; new extractors could compensate downstream users, purchase additional rights, or provide alternative supplies (e.g., Hartman and Seastone 1970, p. 11; Milliman 1959, p. 54). But rights systems in the U.S. are again deficient with regard to these sales. Such transfers would also face relatively high transactions costs, and would have to insure tenure certainty to avoid external effects (Burness and Quirk 1980, p. 34). If instead rights were defined in terms of "consumptive use" without reference to entitlements to return flows, transfers would not cause third party-effects if flow constraints were not binding (Johnson et al. 1981, p. 283).

The likelihood of externalities depends on both the special characteristics of water and how governments design the institutional framework for allocating those rights. It is not always clear that intervention by government, though, solves the problem of externalities. To what degree are boards able to limit those dilemmas?

Corporation failure in collective choices

A third solution advocates the use of conservancy districts, governed by boards, so that rights can be reallocated on a competitive contract basis (Howe et al. 1982, p. 387). The boards charge fees that recover the costs of acquisition and contracts, and make allocation decisions for the district (including assigning contracts for water allocation). The idea is that the use of these boards avoids third-party effects because the board weighs the results of each reallocation of extraction rights. It is also thought that such boards minimize

transactions costs because of the central role they play in all potential transfers of rights. Essentially, these kinds of districts play roles similar to those of publicly held corporations or quasi-nongovernmental organizations (quangos) (e.g., Bertelli 2006). Quasi-judicial boards are independent from government and not pure market players, yet we often see the use of these boards as limiting the prospects for rent seeking. This is the case even though the boards often originate with the voters of the water district or other elected bodies, making their fate dependent on the people they are supposed to serve. Below we offer an extended case analysis from Washington State, where origination resides in an elected body.

Key in this choice is beliefs about the relative efficacy of profit-seeking agencies versus bureaucratic agencies (e.g., Donahue 1991). The difference can be seen as one of contracting for results versus contracting for allegiance. On one hand, these arrangements work when "the product desired can be defined in advance; the government can choose among several competing agents; the product delivered can be evaluated unambiguously; poorly performing agents can be replaced or otherwise penalized; the costs of poor performance (in any one contract) are limited; and, the government neither knows nor cares much about the means of achieving public goals" (Donahue 1991, p. 195). On the other hand, the match is not perfect in the case of surface water: conservancy boards still face problems in defining "production" in the case of water (e.g., stocks versus flows); the choice of which board should oversee the process is still a collective one; and, it is impossible to trace the costs of poor performance to any one contract because the entire product is jointly determined. Conservancy districts may know more than government about the how to achieve public goals in the allocation of rights to surface water, but they are not necessarily "profit-seeking" agencies in the traditional sense.

But neither are conservancy districts pure public agencies. Bureaus work well when "requirements are uncertain and public to revision; competition is difficult or impossible to arrange; results are harder to evaluate that activity; activities believed to produce value can be made routine, and agents can be sanctioned for departure from routine; the costs of failure (in any one project) are high; and, means as well as ends matter" (Donahue 1991, p. 194). In the case of allocating surface water a few of these conditions are satisfied: the requirements are uncertain and revisable, competition is difficult to arrange, results are hard to evaluate, and the costs of failure matter. Clearly, though, means matter just as much as ends. But with surface water it is very difficult to routinize activities because districts vary in size, scope, and responsibility from state to state (Rosen and Sexton 1993). It may also be that local water users cannot easily monitor or sanction the boards, who are presumably their agents. We see in the case of Washington State (discussed below) that regulatory action ultimately rests with the state government and not the boards, which leaves local authority constrained. Instead, conservancy districts are hybrids—neither fully private nor fully public solutions to the problem of reconciling an institutional framework with water's special characteristics. Conservancy districts attempt to avoid third-party effects by having the board weigh the results of each reallocation of extraction rights and minimize transactions by acting as a "market maker" for rights transfers.

Whether this happens depends on how a board reconciles a basic tension: balancing the reallocation of rights with the subsequent activity of monitoring those reallocations. We see boards as being at best a second-best solution to the allocation problem. Pure markets do not work in most cases because of market failures. The traditional Pigovian solution is susceptible to government failure. The power of boards as a second-best solution is also contingent: it depends on to what degree boards can avoid the peculiar problem of corporation failure. By corporation failure, we refer to the problem of "monitoring the

monitors". Specifically, organizations are more efficient than markets because they rely on team production (Alchian and Demsetz 1974). Joint production in organizations is accompanied by a dilemma: how to distribute the gains that arise when organizations do a better job than markets at getting people to work together. A monitor solves this corporation problem by insuring that people live by the agreements they made in the interest of greater social benefits. "Corporation failure" occurs when the monitor faces incentives to extract greater resources from the corporation than is necessary to produce stability and optimal choices (Holmstrom 1982; Eswaren and Kotwal 1985). This type of failure, which is a type of "double moral hazard" in the hierarchical relationship between the monitor and the monitored, haunts all organizations and all hierarchies (e.g., Miller and Whitford 2007). Corporation failure means that conservancy districts—just like markets and governments—may fail to fully reconcile the diverse pressures present in surface water, with its combination of spillovers, rent-seeking behavior, and common pool resource properties.

Conservancy districts are potentially a strong second-best solution. In some ways, "we should worry much less about whether competition in a given case is perfect and worry much more whether there is competition at all" (Hayek 1948, p. 105). Yet, these kinds of boards are "not conspicuously efficient—certainly not efficient enough to be used as a standard for the public sector" (Garnsey 1962, p. 199). The likelihood of market and government failure depends on how property rights are defined. High uncertainty makes institutional reform a less viable route to efficient allocation. For all their problems, market transfers may get us pretty close to equimarginal valuation and allocation, especially if trading institutions help provide protection of third parties against spillover effects. It is unlikely that any solution mitigates completely market and government failure, so the question is which partial solution gets us closest. How close are conservancy districts to being a second-best solution that improves efficiency and minimizes third-party effects?

Conservancy boards are neither fully private nor fully public. As they become more public—as happens if all stakeholders take part in every decision—they look more like communal "ownership" system. Becoming less public increases the likelihood of corporation failure since the monitor can select how to distribute the benefits the conservancy district is supposed to capture in the first place. The ability of conservancy boards to fill this gap will depend on the degree to which boards avoid corporation failure. The problem is not a simple one to solve; it involves a commitment on the part of the board (or its designers) to restrain the body from deviating from fair allocations that satisfy the needs and interests of users, protect third parties, and improve social welfare (e.g., Miller 2000).

We next turn to an assessment of the performance of two alternative mechanisms for the management of water allocations and rights to surface water. Our cases, drawn from California and Washington, are intended to illuminate and gauge, in turn, the ability of boards to serve as a second-best design strategy.

Evidence on three types of failure

In this section we offer evidence from two cases that provide examples of how markets and governments fail in the management of common pool resources, in our case surface waters. Our first case is from the Imperial Irrigation District (hereafter IID), located in southern California. The second case is from the management of surface waters throughout Washington State. While the IID delivers water over a mountain range into a once barren desert, Washington State's district spans a variety of micro-environments, including rainforests, temperate forests, high mountain peaks, and vast arid stretches in the eastern

part of the state. Both states have both appropriative and riparian water rights systems. Together these cases help clarify how government and market failure in the transfer of water rights interact with the use of conservancy boards. Our focus in each case is different, though. In the first, we focus on the dual problem of coordinating allocation and demand within the district while coordinating allocation and demand across districts. The second case shows how public agencies work to insure that boards are able to make educated decisions, and how that monitoring limits the ability of boards to act in a proactive way. Both cases, though, show that the specter of corporation failure looms when boards are seen as a solution to the twin problems of government and market failure.

The Imperial Irrigation District

The main water rights schemes, which were set up early miners in the dry desert landscapes of southern California, rely on an appropriative rights approach to allocation (Simpson and Ringskog 1997). The main justification for using this system was to provide the water where it was most needed—at that time, for agriculture and mining operations often located far from any water sources. Early visitors to the Imperial Valley in California saw it as little more than a desert wasteland: located far from any source of water, hot, and not an ideal location for human habitation. This began to change during the late 1800s when a railroad surveying team discovered that the area was below sea level and thus "could be irrigated by a gravity flow canal diverting from the Colorado River" ("About IID" 2007). Using an appropriative water allocation system helped these early visitors make the investments that would lead to the development of one America's most productive agricultural areas.

The Imperial Irrigation District (IID) was created in 1911; by 1922 it had purchased 13 mutual water companies and was delivering water to nearly half a million acres ("General History" 2007). The IID began diverting water in 1942 from the Colorado River via the All-American Canal at the Imperial Dam. Today the IID is the largest irrigation district in the nation and has in excess of 3,000 miles of canals and drains. Today, as was the case in the 1920s, IID irrigates nearly half a million acres in an area consisting of nearly 7,000 farms (Rosen and Sexton 1993). Agriculture in the Imperial Valley is split between field crops (around 80%) and garden crops (around 20%) (Rosen and Sexton 1993). Even with little to no rainfall in the Imperial Valley, farmers had the incentive to raise water intensive crops, such as lettuce, because water was provided at well below market prices. It became clear over time that the delivery system in the valley was inefficient, leading to large losses of water in delivery. By 1988 IID faced strong pressure from the State Water Resources Control Board (SWRCB) to line its canals because of the tremendous loss of water into the ground (Kubasek and Silverman 2005). Water losses came from the delivery of water (about 300,000 acre feet per year) and on-farm losses (about 500,000 acre feet per year) (Rosen and Sexton 1993, pp. 43–44).

The pressure to limit these losses came in part from a compact between the states through which the Colorado River flows, which was set up in 1922. The purpose of the compact is to assure that withdrawals of water provided for all the demand sources located along the river. However, the rapid growth of southern California quickly outstripped growth in neighboring Arizona and Nevada, resulting in IID and its partners drawing not only their own water allocation but also the water demanded by upstream states (Simpson and Ringskog 1997).

IID agreed to line its canals on the condition that they would be granted the rights to the conserved water. Some of the IID's partner districts (other districts that receive their water from IID canals to serve other areas of the state) were also hesitant to implement conservation measures for fear of losing the right to the water they conserved. These concerns reflect the limited incentives the districts encountered to conserve because they lacked assurance that given their conservation efforts they would be able to keep all of the water they were currently allocated. Moreover, for some water districts the losses they experienced were simply passed onto downstream water users, and for others the water losses were due to seepage into the ground—resulting in losses of up to 80% of water in the canals (Kubasek and Silverman 2005). The SWRCB decided that the water losses that were recoverable, such as those lost to seepage, would not result in a loss of allocation rights. In contrast, water districts in northern California, whose losses were passed to downstream users, did not get to keep their conservation savings because it yielded a decreased supply downstream.

This ruling shows the incentives for conservation efforts—incentives that improved the market structure for the IID and partner water districts in southern California. The final agreement between IID, its partner districts, and SWRCB resulted in IID agreeing to pay up to $200 million for water conservation efforts to improve delivery and irrigation technology (Simpson and Ringskog 1997). In exchange for the investment IID received 122 million cubic meters of the conserved water per year for 35 years (Simpson and Ringskog 1997). It is notable that the Imperial Valley's topography results in losses from irrigation running off into a saline basin, which is unusable water. In the end, the IID's agreement to change its technology resulted in benefits for all the parties involved. While the resulting water savings in the canals generally did not benefit farmers, it benefited third parties and helped create saleable surpluses onto the market (Simpson and Ringskog 1997).

Washington State Water Conservancy Boards

Washington State is really two distinct hydraulic states, cut in half by the Cascade Mountains. The whole state receives an average 40 inches of rain each year, but the western half receives about 70 inches while the eastern part receives only 20 inches (USGS, 1999). Both sides of the Cascades have vast stretches of agriculture, although the eastern part of the state is more rural than western Washington. Runoff from the Cascades and other ranges to the east and north, though, provide river waters for irrigation.

The transfer of water rights, mostly in eastern Washington, occurred for a very long time, but observers saw the system as inefficient and backlogged (Washington State Legislature 1997; Washington State Department of Ecology 2004). To reduce backlog and increase efficiency, in 1997 the Washington State legislature authorized the creation of water conservancy boards (WCBs) to move water-permitting decisions to the local level (Washington State Department of Ecology 2007a). Two counties established WCBs as pilot projects in 1998, which evolved into permanent rules for WCBs in 1999.

When first authorized the boards were limited to three members and their jurisdiction limited to county boundaries (Washington State Department of Ecology 2004, 2006). In 2001, the legislature changed the statute to provide for boards composed of three or five members and whose boundaries could span counties—able to serve one county, multiple counties, one watershed, or multiple watersheds (Washington State Department of Ecology 2004). Specifically, when the WCBs cross county lines, one county must be assigned as the lead county to communicate with the Department of Ecology, but all counties jointly

appoint members to the board; no WCBs yet span county boundaries (Washington State Department of Ecology 2004). In governance terms, the WCBs are independent units of local government(s) created through resolutions of the county (or counties) served by the particular board (Washington State Department of Ecology 2007b) and funded through grants and fees charged to applicants (Washington State Department of Ecology 2004). One important provision is that applicants can bypass these boards if they desire by applying directly to the state (Washington State Department of Ecology 2004).

Since their authorization in 1997, 21 counties have established WCBs (16 in eastern Washington and five in the west). All but four of eastern Washington's 20 counties have WCBs; most of western Washington is without WCBs. No new boards have been established since September 2002, though Pierce County, one of western Washington's most populous counties, recently considered creating a WCB (Washington State Department of Ecology 2006).

County governments appoint board members. They come from varying backgrounds, with many not being water experts. As a solution to this expertise problem, the Washington State Department of Ecology now requires that all new board members attend 32 hours of training. The training, which is also provided by the Department of Ecology, covers water related topics and also provides information on open government requirements and reporting requirements. Each board member must get at least 8 hours of continuing education in following years (again provided by the Department) (Washington State Department of Ecology 2006). The decision-making processes used by the WCBs vary by county. Some boards have chosen to retain investigatory power, while others request that the applicants hire a consultant for the job and then the board reviews the consultant's work. A 2004 audit by the Washington State legislature found that WCBs that investigate the applications themselves required "less modification or are less likely to be reversed by (the Department of) Ecology" (Washington State Department of Ecology 2004: i), yet they found that neither approach approved applications more quickly (Washington State Department of Ecology 2004). Due to their independence, the WCBs provide their own clerical, legal, and other support services, with the level of support provided varying widely by jurisdiction. Some contract with local conservation offices, while others have chosen private firms or contractors (Washington State Department of Ecology 2006).

One innovation in Washington State is that it is also possible to purchase water rights from an open exchange on the state level or within a specific county, although this approach has yet to be widely adopted. The degree to which this "outside option" checks the power of the decentralized WCBs is very limited: the state Department of Ecology's "Washington Water Exchange," which lists available and wanted water rights, only includes a small number of rights available, and the Department does not approve or support the site beyond providing the webpage (Washington State Department of Ecology 2007c). Similarly, county WCBs have also been slow to develop rights exchanges: only two of the 21 counties use an exchange (Washington State Department of Ecology 2004).

How effective are the WCBs? In general, the decisions made by WCBs statewide have produced high approval rates. In the two-year period from November 2002 to October 2004, only one case resulted in a denial of transfer out of 168 applications made and 132 decisions on cases (Washington State Department of Ecology 2004). In the next two-year period (between November 2004 and October 2006) the WCBs approved all 148 in the decisions on cases made from the 220 applications for transfers (Washington State Department of Ecology 2006). But this rate of approval may be illusory because, according the Department of Ecology's report to the legislature, WCBs can decline applications they know they will not approve (Washington State Department of Ecology 2006).

Additionally, WCBs encourage applicants to withdraw their applications without a decision if the board knows they will not allow the transfer request. Generally, though, the WCBs have reduced the backlog of applications pending before the Department of Ecology. Since 2001, the statewide backlog of water right change decisions has fallen from 2,000 to about 1,000 pending applications (Washington State Department of Ecology 2006, p. 22).

These metrics also understate the role of WCBs in their local water allocation processes. In addition to making decisions about rights allocations, WCBs also have an important public education function in their communities (Washington State Department of Ecology 2004, 2006). Between 2004 and 2006 WCBs reported over 500 contacts for information from their communities (Washington State Department of Ecology 2006), which also helps reduce the backlog of cases pending when applicants are better informed about how to transfer or purchase water rights.

The tension is really between the WCBs and the Department of Ecology. Ecology has the final say about all transfers and can reverse a local board's decision to grant/deny a transfer of rights. While WCBs have not yet been sued, three WCBs have sued the Department of Ecology.[4] Tension has also been expressed as a broader problem of board sustainability in some jurisdictions. The education requirement the Department of Ecology sets has made board members ineligible and in the end, has made entire boards ineligible. Specifically, a board of three members with more than one ineligible member is no longer operable. As of November 2006, 25% of all commissioners statewide were ineligible for service (Washington State Department of Ecology 2006). In some cases, newly appointed WCB members refused to attend the initial 38 hours training, while in other cases existing members failed to attend the annual required 8 hours of continuing education. Rather than single out individual members, when boards are inoperable all a county can do is dissolve the entire board. In a number of cases, counties have reappointed ineligible board members, perpetuating inoperable WCBs. Notably, all of the counties with ineligible WCBs were in the wet western side of the state, not the dry eastern side of the state. Only one WCB in western Washington is still active (the county containing the state capital, Olympia). In contrast, boards that were established early appear to have maintained their strength (Washington State Department of Ecology 2006). One recent solution by the state to the dilemma of maintaining quorum has been changes to the statute that allow for alternate members of WCBs. Unfortunately, many of those alternate members also suffer from ineligibility.

We also note that the WCBs face troubles about the role of consultants in the fact-finding process. When boards do not actively investigate applications, consultants take on the role of investigating and presenting the facts of the case to the WCB. These consultants are often more educated in water issues than are board members; in some instances the consultants are former board members. Consultants are fully aware of the process and ultimately focus a great deal of their energy on the Department of Ecology because "it is Ecology that they must ultimately satisfy and not the board" (Washington State Department of Ecology 2006, p. 11). In some ways, the shift toward consultants has made some boards less relevant. Since consultants often have superior knowledge, many WCBs

[4] Benton County has sued twice, losing once and settling in the other (Washington State Department of Ecology 2004; City of West Richland, et al v. Department of Ecology, et al. 2004). In 2005, Klickitat County sued the Department of Ecology over a decision reversal; the case was settled out of court by modifying the agreement the Klickitat WCB had made with applicant (Washington State Department of Ecology 2006).

express sentiment that they should defer to the experts (Washington State Department of Ecology 2006). Of course, consultants gain prominence due to time and financial burdens: WCB members are all volunteers and because boards are independently funded, consultants let the board get work done cheaply and quickly. The state has sought to reduce the influence of consultants by ruling that Ecology can review all WCB decisions separately from the case presented to the WCBs, limiting the influence of consultants, as well as generate new findings of fact separate from those presented to the WCBs (Washington State Department of Ecology 2006). Of course, while this monitoring solution probably reduces the likelihood of corporation failure, it increases the likelihood of government failure.

Both of the cases we offer here show how conservancy boards provide an alternative to use of government and markets to provide of scarce common pool resources like surface water. While they are no panacea to the ills of water rights transfers in these, and many other cases, they have reduced the effects of the government and market failures that are seen in other methods of distributing these rights. Yet, both cases provide evidence that corporation failure is a common concern whenever boards are used to allocate water rights and monitor their enforcement. The Imperial Irrigation District, in using its power to act as a monitor, had to negotiate to keep the gains that resulted from conservation, which ultimately lead to dramatic changes in water delivery and use by farmers. In that case the government, the market, and the conservancy board were not able to act in isolation to obtain an improved allocation of water. While WCBs in Washington State have shown it is possible to reduce the time required to get a transfer permit approved, the state has retained veto power, thereby holding on to the ability to capture some benefits—or at least to limit the likelihood of corporation failure at the WCB level. In sum, while boards are a second-best solution to the problems of market and government failure, their long-term performance is bound by the ability to credibly commit to a monitoring system that insures that the decisions of boards will be fair and more efficient than those other institutions could deliver.

Discussion

Counter to the conventional wisdom that holds that the market allocates resources in line with equimarginal valuation—where the value of marginal products is equated in alternative uses—surface water transactions suffer from specific and unavoidable conflicts due to its atypical characteristics, the unique and specific market structures that have evolved over time, and the twin problems of market and government failure that are present in these markets. With non-exclusive common pool resources, uncaptured costs, the lack of incentives about total extractions, and the impact of over-extraction by any one individual on the marginal extraction costs of all other users means that the public frequently demands solutions based on coercion, incentives, or appeals to sentiment. The problem is that Pigou's "trustee for unborn generations" faces three possible points of failure, depending on the legal framework that establishes the governance structure for the trustee.

This article shows that a series of fundamental dilemmas result from the combination of spillovers, rent-seeking behavior, and common pool resources in the case of the regulation of access to surface water. Since surface water supply is often a nonexclusive resource, the prevailing framework for water rights depends largely on rationing transactions over bargaining transactions. The two basic legal doctrines of riparian rights and prior appropriation are largely consequences of water's scarcity and of the existing and projected

demand in a given region. The problem is that water's special qualities given this combination of spillovers, rent-seeking behavior, and common pool resources complicate an assignment of water rights in any legal framework. These atypical characteristics mean that specific market structures are necessary to efficiently allocate those rights, but that given the role of the state in assembling these structures, market and government failure make it extremely difficult to uniquely form a legal solution to assign property rights to surface water. Moreover, the use of quasi-judicial conservancy boards may fail in the same way as markets and governments through a special form of corporation failure.

Together, these dilemmas indicate that legal, economic, and scientific solutions cannot uniquely combine to overcome basic "political" problems in the formation of stable and efficient property rights. Historically, market failures like those present in common pool resources like surface water have formed the basis for calls for legal doctrines implemented by coercive governments to replace the order in exchange that the market usually brings. But the presence of that legal doctrine creates the subsidiary political problem of government failure, with its attendant concerns about the stability and efficiency of collective choices and the mechanisms that produce them. The third solution in surface water regulation and legal theory—conservancy districts—is neither a fully public nor a fully private solution. Even so, conservancy districts by their very construction and because of the social problem they are constructed to solve—the allocation of surface water—will produce perverse incentives for the monitoring board. At a minimum, that legal solution cannot reconcile the dilemmas present in the early choice between markets and governments. A more pessimistic view, of course, is that those incentives are reflected in the unusual degree of antimony present in their decisions and choices. They may in fact be the only choice—a true second-best solution. But the core dilemmas and the search for optimal legal solutions remain.

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