ENVIRONMENTAL WATER MARKETS:

RESTORING STREAMS THROUGH TRADE

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Terry L. Anderson and Laura E. Huggins

ISSN 1094–655

TABLE OF CONTENTS

TO THE READER

Western water law is a bit peculiar. It provides limited usage rights to parties who have legal claims on water. Most of the rules date to the settlement of the western United States in the nineteenth century. The traditional rules, which were codified by state legislatures, worked well in an agricultural economy. But, as changes in values evolved, some limits inherent in the prior appropriation doctrine have become apparent. It was, and still can be, difficult to change the use of water from its historic designation to one with greater value. Such is the case for restoring instream flows through water markets.

Societies with strong property rights allow parties to protect their property, develop it, trade it, or give it away. They enjoy greater prosperity and freedom than societies that impose many restrictions on property or suffer from a lack of clarity in rules. As Brandon Scarborough explains in this *Policy Series*, restrictions in water rights and uncertainty about how particular water trades can be affected limited the ability of parties to voluntarily use water for environmental benefits.

As often happens when the rules are unclear, people make do and struggle to create new arrangements that allow resources to move to higher-valued uses. Water rights have evolved in recent years as parties express desires to sell, lease, or give water for environmental or recreational purposes. Legal entrepreneurs plowed new ground. Some states have assisted in the move to expanded water rights, others have been less supportive. This *Policy Series* provides guidance for improving the legal environment for parties who wish to engage in the beneficial exchange of water rights.

This essay is part of the *PERC Policy Series* of papers on timely environmental topics. This issue was edited by Roger Meiners and Laura Huggins and designed by Mandy-Scott Bachelier.

ENVIRONMENTAL WATER MARKETS:
RESTORING STREAMS THROUGH TRADE

A 1.3 million mile network of rivers and streams winds through the American West. It is a lifeline to economic, environmental, and social amenities. Water diverted from streams supports burgeoning communities, businesses, and an expansive agricultural sector. Water left instream is vital to the maintenance of complex riparian ecosystems, water quality, and species conservation. It also provides recreational opportunities and aesthetic values. In recent decades, competition among offstream and instream water users has intensified as pressure to divert water from streams for growing populations is countered by a widening interest in improving and protecting stream flows for environmental and recreational purposes.

Historically, the demand for water and the institutions governing its allocation and use have favored economic applications, such as mining, agriculture, power generation, and municipal uses. As a result, much of the West's scarce water resources are allocated to uses that are inconsistent with new demands for free-flowing streams. Moreover, because western water laws evolved in accordance with the desire to divert water from streams, efforts to maintain or improve stream flows have been complicated.

Much of the West's scarce water resources are allocated to uses that are inconsistent with new demands for free-flowing streams.

The institutions governing instream flows have undergone considerable changes, especially in recent decades. Early efforts to protect flows that relied on state regulations and restrictions on new water developments are being replaced with market-based options that let voluntary buyers and sellers trade water rights for instream purposes, such as protecting fish. Market activity is increasing, but additional changes would expand opportunities for trade, reduce the associated transaction costs, and increase the amount of water flowing through streams.

This *Policy Series* explores the evolving institutional settings in western states[1] for restoring and preserving instream flows. The focus is on how markets can provide an efficient and equitable solution for allocating water among increasingly competitive offstream and instream demands, while also providing economic incentives for improved water use efficiencies and conservation. This essay also identifies the underlying barriers that complicate or thwart water markets and provides thoughts on how they may be overcome.

WATER RIGHTS IN THE WEST

To clarify the challenges facing the protection of instream flows, it is important to understand the institutions that govern water use and allocation and how they have evolved. The 1848 discovery of gold at Sutter's Mill in California sparked a migration to the region and with it, the need to divert water from streams. Lacking an effective governmental authority,[2] miners established an extralegal system to protect increasingly scarce water resources. Property rights to water evolved based on the prin-

cipal of priority: "first in time, first in right." "He who first turned the waters of a stream from its course, or of a lake from its bed, and applied them to beneficial and continuing use was first in a property right in that stream commensurate to and concurrent with that use" (Hess 1916, 484). Subsequent users could stake a claim to remaining stream flows only if more senior right holders' entitlements could first be fulfilled. In drought years, some users might not receive any water while others would collect only a portion of their allotment. In other words, having a water right, especially a junior priority, was no guarantee that one received a full entitlement.

As the West developed, this system of water allocation, known as the doctrine of prior appropriation, was incorporated into state law. New water users could obtain a legal water right from the state if certain conditions were met. Most commonly, states required water to be physically diverted from streams[3] and used in a beneficial manner as determined by the state. In addition, rights would be issued only if the additional diversion of water would not harm a prior (more senior) appropriator's right. To be more precise, water right holders do not take ownership in the physical water being diverted from the stream; rather the state grants a right to use water in a beneficial manner—a usufruct right. The states, through their constitutions, maintain ownership of the water resource for the public, thereby giving states the authority to create and appropriate rights to water (see Sax et al. 2000). Nevertheless, existing water rights are generally secure and may be held indefinitely unless abandoned or forfeited by nonuse or non-beneficial use.[4]

Transferability of Rights

Water rights established under the prior appropriation doctrine may be transferred to other users through voluntary transactions. In general, water right holders may lease, sell, or

trade their water rights, or a portion thereof, assuming the state's requirements of a diversion, beneficial use, and non-injury to other users are maintained.[5]

The ability to trade water rights among various applications is particularly important in the arid West for a number of reasons. First, it provides a voluntary means of reallocating scarce water resources to meet new or changing water demands. For example, as urban economies continue to expand, municipal and industrial demands are being met in part through acquisitions of other water rights, primarily from agricultural users. Similarly, as the desire to improve instream flows widens, voluntary trades with current water users will help to meet those demands.

Second, because much of the West's available water supplies are currently allocated to water right holders, there is little un-appropriated water available to prospective new users. Historically, water availability concerns were addressed through supply-side strategies, such as the construction of dams and reservoirs to store and manage water. Although effective, new infrastructure projects are generally no longer feasible because of extraordinary economic costs and growing environmental concerns. And thirdly, the ability to transfer water rights facilitates the reallocation of scarce water supplies to higher valued uses, which creates incentives for conservation and improved water use efficiencies. Throughout the West, the value of water varies with location and use, creating a wide disparity in prices and the potential for economic gains through trade. For example, in one of the largest transfers of water from farmers to municipal users, San Diego County, in 2003, offered farmers in the Imperial Valley in Southern California roughly $260 per acre-foot of water. The farmers had been paying $15 to $20 per acre-foot (Murray 2003). In general, prices for municipal or industrial applications are higher than among agricultural uses (Brewer et al. 2007) and illustrative of the potential benefits that could be gained from trade.

Defining Rights

Uncertainty in one's right to water introduces added costs and diminishes the incentive to pursue trades.

While the prior appropriation system provides the basis for water markets and reallocation of water to meet changing demands, certain characteristics of water rights fundamentally affect their transferability. Most importantly, water rights must be well defined and enforceable. Uncertainty in one's right to water, ability to use it in a way deemed beneficial to the user, or ability to protect rights from harm, introduces added costs and diminishes the incentive to pursue trades. As a consequence, the expected gains from trade decline, trading activity falls, and water remains in lower valued uses. Imagine wanting to buy a plot of land now used for farming. Your intention is to restore the land to native grasses and forest cover for wildlife. You are willing to pay market price for it until discovering the deed to the land includes unclear information about the lot size, where the property lines are, and who the rightful owner is. In addition, you learn the state may prohibit certain land uses and it is not clear that the land is protected from other users. Your willingness to pay immediately declines due to the costs of defining the details of the property, the uncertainty of trespass, and ambiguity in the long-term investment in the land. The result: fewer land transactions or investments will be made, more land will remain in lower valued uses, and a smaller amount of wildlife habitat will be provided. Similar conditions can arise when acquiring water rights, notably when the end use is for a non-traditional use, such as instream flows.

A surface water right certificate typically defines the place and nature of use, amount of water as a measure of flow or volume, and the priority date. Throughout the West, however, the actual amount of water used often differs from that stated on the

water right. "Early appropriations. . .were frequently in excess of actual need because there was no administrative system to police the amounts claimed" (Sax et al. 2000, 236). As a result, the paper claims to water often exceed actual use. Moreover, as irrigators switched crops and implemented new technologies to deliver and apply water more efficiently, historical water use may have declined, further widening the disparity between paper claims and actual use. The same disparity arises today in heavily or over-appropriated basins in which more junior water right holders receive little or no water in dry years despite their stated entitlement. In other instances, the volume of water normally diverted may be in excess of one's paper claim. Such illegal or excessive diversions are not uncommon and may go uncontested.

Only once a transfer is initiated, a dispute is filed, or a state 'general' or basin specific adjudication is mandated, are water rights investigated and more clearly defined. Every western state is in the process of clarifying existing water rights, but the process is lengthy and will take decades to complete. The Montana Water Court, for example, was created in 1979 to facilitate statewide adjudication and decree of more than 219,000 water rights. Sixteen years later, overwhelmed by the process, the legislature increased funding and available resources to the Department of Natural Resources and Conservation (DNRC) and the state Water Court to try to meet the projected completion date of 2020.[6] Although the process is slow and costly to taxpayers and water right holders, it will help states inventory available water resources, better clarify existing rights for water right holders, and identify abandoned or forfeited rights to water that may be appropriated to other users.

To be clear, the adjudication process is intended to better define right holders' claims to use water and provide legal clarity of rights in order to settle disputes. It does not, however, clarify rights to the extent necessary for transfers to other users. In fact, the amount of water listed on a decreed water right often dif-

fers from the amount that may be transferred to another use or user. In order to protect third parties (the "no injury" rule),[7] the state or court can restrict the amount that may be transferred. In the case of transfers to instream flows, this amount is generally limited to the historical consumptive use portion of one's right—the amount of water historically consumed through evapotranspiration[8] and in products such as crops that is not returned to the stream.

Protection of all legitimate right holders is critical to an efficient market.

Protection of all legitimate right holders is critical to an efficient market. However, where rights are unclear, disputes are common and may tie up transfers for years (Thompson 1993). Moreover, "the no harm rule makes any trade vulnerable to a variety of constituent claims, some legitimate and some pure holdup" (Libecap 2005). In many cases, disputes may not be limited to only other water right holders. In California, any party, whether a water user or business supported by water users (agricultural product suppliers, local stores, schools, etc.), may protest transfers if they believe they will be adversely affected by the transfer (Dutkowsky 2009). With multiple parties having the right to intervene in cases of proposed transfers, the transaction costs can be substantial while the expectation of such costly disputes creates a strong deterrent to entering into trades (Hennessy 2004; Ruml 2005). To illustrate, imagine if existing property owners could intervene in your attempt to lease or sell your home, claiming the new residents will somehow injure their property rights. Fewer homes would be sold or rented, as the costs of such deals would increase.

Enforcement of Rights

Equally important to well-defined and tradable water rights is the enforcement of rights. Throughout the West, excessive withdrawals and illegal diversions deplete scarce water resources and

harm legitimate right holders as well as stream flows. The costs of enforcement reduce expected gains from trade and discourage potential buyers and sellers from entering into transfers.

In general, states do not monitor and police all water users. Thus, illegal or excess withdrawals can go unnoticed until a dispute arises or adjudication is initiated. Even when rights are enforced by the state, fines may be insignificant and provide little deterrent for infractions. For example, until recently the maximum penalty in Washington was $100 per day—potentially less than the value of the water or the cost of buying water from other users. The fines were increased to between $100 and $5,000 per day depending on the severity of the violation, but only seven fines have been assessed since 2003 because "monetary penalties are difficult, contentious, and require extensive staff time and attorney resources" (Washington Department of Ecology 2008, 1). In Montana the fines are as high as $1,000 per day, but only a handful have been issued as few violations are reported due in part to a lack of anonymity and fear of repercussions from other users filing a complaint with the state.[9]

Despite constraints on the transferability of water rights, markets have proven to be an effective tool in reallocating water to adjust to changing demands. As water resources have become more scarce and valuable, buyers and sellers have found ways to overcome barriers and move water to higher valued uses. People wanting to enhance stream flows for aesthetic, environmental, and recreational uses through voluntary channels are now facing similar challenges. Moreover, a long history of water laws and institutions favoring economic water uses poses an additional constraint to providing water instream for non-traditional uses.

Excessive withdrawals and illegal diversions deplete scarce water resources and harm legitimate right holders.

PROTECTING STREAM FLOWS

Historical demands for water, with the exception of sufficient water for navigational purposes or for hydropower generation, have been almost exclusively for offstream uses such as mining, agricultural, municipal, and business applications. Undiverted water was often seen as wasteful. As President Hoover said in 1926, "true conservation of water is not the prevention of its use. Every drop of water that runs into the sea without yielding its full commercial returns to the nation is an economic waste" (quoted in Clements 2000, 79).

This sentiment was instilled in western water laws with the requirement of a diversion and state-specified definitions of beneficial uses, which did not initially include environmental or recreational uses. These laws effectively precluded voluntary agreements to protect or improve stream flows, whether through new appropriations or trading of existing offstream water rights to instream uses (Huffman 1983, 273). Gradually, and to varied degrees, states have expanded legal systems to recognize instream flows as a beneficial use and to provide a means of restoring or protecting them, including the reallocation of water through voluntary trades.

Today, there are basically four ways to protect instream flows. One relies on state restrictions or regulations that limit further declines in flows by essentially closing streams to new appropriations or requiring mitigation of groundwater withdrawals.[10] Second are cases involving the public trust doctrine or the Endangered Species Act (ESA).[11] In these cases, one's right to divert water from streams may be denied or diminished in order to maintain sufficient water instream for the public interest, including protection of threatened or endangered species. A third is to appropriate water for instream purposes. Like water rights for offstream uses, private parties or state agencies apply

for rights to leave water in its natural course. And fourth, stream flows may be improved and protected by acquiring existing water rights from offstream users, so as to leave water instream that would otherwise have been diverted. Western states have, with mixed results, adopted one or a combination of these strategies to protect stream flows.

Maintaining Status Quo Flows

To the early settlers in the West, the protection of streams for fish, recreation, or scenic values was of little concern. Instead, water was most valuable when diverted away from streams for uses such as mining and agricultural production. As the region developed, strong competition for water created a race to establish diversions and secure water rights. Despite lacking a well developed recording system or accurate inventory of available water, states appropriated water in step with these demands. As a result, by as early as 1900, many streams were already heavily or over-appropriated (Sherow 2007, 96). This meant the amount of water claimed by right holders was close to or exceeded the amount of water in streams.[12]

Once interest in protecting streams developed, much of the West's water was already allocated to other uses. In addition, state legal systems governing water use and appropriation did not recognize environmental or recreational uses. As a consequence, anglers, environmentalists, and recreationists could neither apply for instream flow rights nor could they acquire existing offstream rights and leave the water instream to improve flows. Hence, people turned to political avenues. States responded by closing streams to new appropriations, in effect providing protection for any remaining (un-appropriated) water. For example, Oregon's leg-

By as early as 1900, many streams were already heavily or over-appropriated.

islature closed 23 streams along the Columbia River Gorge in 1915 to protect existing flows for scenic waterfalls.[13] Similarly, in Idaho in the 1920s, the state set limitations on new diversions to maintain lake levels for the preservation of scenic beauty, health, and recreation.[14]

States adopted new strategies to protect existing flows from further declines, but continued to exclude private involvement in favor of expanded regulatory oversight.

Over the years, states adopted new strategies to protect existing flows from further declines, but continued to exclude private involvement in favor of expanded regulatory oversight. Common state regulations include the establishment of minimum flows[15] and the appropriation of new instream flow rights. In practice, the two strategies are similar. Each defines a specified amount or flow of water instream (not currently appropriated to other uses) that is off limits to future diversions. Because minimum flows and new appropriations could only be created from water not currently appropriated to other uses, existing right holders' entitlements were unaffected.

Shortcomings to state policies have been identified that bring into question their effectiveness in meeting demands for water instream. First, minimum flows are generally established by administrative ruling and thus are subject to political influence from special interests.[16] As such, why and where they are established may not always be in accord with economic or ecological demands. Imagine the opposition from a farming community to a state agency's proposal to set minimum flow requirements that could effectively eliminate any potential to expand agricultural production. In addition, minimum flow designations may be temporary and subject to appropriation to other uses under a different administration that may interpret the statutes in favor of offstream water users (Gray 1993).

In Montana, for example, instream flows can be reallocated to other users, including offstream, once every five years by "showing that the need of the petitioner [the new user] is greater than that identified by the original reservant for the instream flows."[17] As a result, benefits from protected streams become uncertain over time and can be erased by the political reallocation of water to some other use.

Second, minimum flows and new instream appropriations can, at best, protect only existing un-appropriated stream flows from future diversions, not improve or restore dewatered reaches. In Montana alone, there are an estimated 4,000 miles of temporarily or chronically dewatered streams that lack sufficient flows to maintain local aquatic species (Montana Fish Wildlife and Parks 2006). Establishing minimum flows in these streams will only perpetuate the existent low flows and inadequate habitat for local species, not restore flows to adequate levels.[18]

Third, by the time states began designating minimum flows and creating new instream rights, there was a limited supply of streams with sufficient un-appropriated water to support target flows. More often, there was insufficient water to support all diversionary needs, much less to provide adequate flows for fish and wildlife or recreation. Where minimum flows and new instream rights have been established, the rights holders are junior to other users, leaving little assurance that flows will be consistently maintained—especially in dry years when irrigation demands are highest and flows are most critical for fish and wildlife.

CAN'T KEEP A GOOD MARKET DOWN

Historically, as the demands for water shifted among various offstream uses, the value of voluntary markets to reallocate water among those uses became clear. Today the same strategy to reallocate water to other uses is being applied to meet new

instream flow demands. The inherent limitations of minimum flow designations and new appropriations have shown that the best way to restore dewatered streams and improve flows is by reducing the amount of water being diverted, whether in total quantity, timing, or location.[19] The most equitable and efficient way to achieve this is by engaging in voluntary contracting with offstream water users to either acquire water rights and leave the water instream or by negotiating a change to their existing right that benefits stream conditions.

Such a market-based approach to water allocation is not a new concept in the West. For more than a century, water has been reallocated among users for offstream uses through voluntary trades. A gradual expansion of water laws to include provisions for the trading of water for instream purposes has created opportunities for market-based transfers of water from traditional offstream uses to provide flows instream for environmental and recreational uses.

Every western state permits the trading of water rights for instream uses, but the variation among states is marked and restrictions on private interests remain widespread. Below is a summary of state specific opportunities for instream flow marketing. Overall, state and federal agencies remain the primary acquirers of water for instream uses; however, as state legal systems broaden to include provisions for private acquisition and for holding instream flow rights, the number of private entities acquiring water for such purposes has increased.

- **Arizona**: In 1994, the state established the Arizona Water Protection Fund, a grant program that provides funds for river and stream restoration projects including acquisition of water for instream purposes. Private efforts to maintain or improve stream flows have been limited. The Nature Conservancy is awaiting approval for the state's first instream flow transfer resulting from a land and water rights

acquisition, where the water will be left instream to provide fish and wildlife habitat.

- **California**: Although California does not permit new appropriations for instream flows, changes to the state's water code in 1991 permit any legal entity to acquire and change a consumptive use right for "purposes of preserving or enhancing wetlands habitat, fish and wildlife resources, or recreation."[20] Water right changes to instream use may be permanent, temporary, or what are referred to as "urgency changes,"[21] creating opportunities for lease agreements and water right sales. Despite this, the complexity of California's water laws increase transaction costs, potentially making smaller, private acquisitions prohibitively expensive (Boyd 2003).[22] Changes are underway, however, and private entities such as Ducks Unlimited and the Shasta River Water Trust have acquired water from offstream users and transferred the rights to instream use.
- **Colorado**: In 1986, the legislature vested exclusive authority to the Colorado Water Conservation Board (CWCB) to acquire water rights by "grant, purchase, donation, bequest, devise, lease, exchange, or other contractual agreement, from or with any person, including any governmental entity."[23] Colorado prohibits private entities from holding instream flow rights; however, any party may acquire an existing right and donate it to the CWCB for instream purposes. Private conservancies such as Trout Unlimited (TU), the Colorado Water Trust and the Nature Conservancy (TNC) have played an active role in preserving and restoring habitat and flows for fish and wildlife species.
- **Idaho**: State and federal agencies lease and purchase water rights from willing sellers to restore stream flows primarily for endangered or threatened species. The water is usually acquired through local rental pools, in which farmers can

lease water on a temporary basis to the agencies. Legislation passed in 2007 allows private right holders to donate all or a portion of water rights to the state to be held in trust for the preservation of minimum flows along the Big and Little Wood Rivers.[24]

- **Montana**: In 1989, Montana's Department of Fish, Wildlife and Parks (FWP) was granted authority to lease water rights to maintain fish flows on a limited number of streams. Legislation passed in 1991 expanded FWP's authority to streams throughout the state. The option to lease water for instream flows was extended to the private sector in 1995, opening the door to private conservation groups such as TU and the Montana Water Trust that employ markets to improve flows for local fisheries.
- **Nevada**: Opportunities for state and private entities to protect stream flows stem from the Nevada Supreme Court's decision which held that instream uses of water for fish and recreation were considered beneficial. Together with state water statutes,[25] this provides for temporary or permanent acquisitions of water for instream use. Private entities are free to acquire water rights from other users and to continue to hold that right once changed to an instream use. Conservation organizations such as TNC, the Great Basin Land and Trust, and Nevada Water Fowl Association have all acquired water for instream use; however, their funding has been primarily from governmental agencies.
- **New Mexico**: Opportunities to improve stream flows through markets are limited. The legislature created the Strategic Water Reserve in 2005, a state funded program to acquire water primarily from agricultural users in order to improve flows for endangered species and to meet interstate water compacts. By acquiring water rights to maintain sufficient instream flows, the state may reduce

or eliminate costly litigation stemming from endangered species and interstate water conflicts. Private opportunities to acquire water for instream use have been complicated by unclear laws governing instream flows and transfers.

- **Oregon**: The 1987 Instream Water Rights Act set the stage for voluntary private exchanges of water from consumptive to instream uses. The law confirmed the protection of water rights designated to instream use without the need for a diversion, while permitting the transfer of existing offstream use rights to instream rights through voluntary lease, purchase, or donation agreements. All water rights for instream uses are held in trust by the state. Private organizations such as Oregon Water Trust, the Deschutes River Conservancy, and the Klamath Basin Rangeland Trust have used markets to restore flows for local fish species.
- **Utah**: Until recently, only state agencies could acquire water for instream purposes. In 2007, statutory changes created a ten-year pilot program extending instream flow market opportunities to certain private interests. Conservation entities such as TU may lease water from farmers and ranchers to provide flows for fish. The pilot program is similar to the one in Montana, which proved to be successful and was made permanent in 2005.
- **Washington**: The legislature established the Trust Water Rights program in 1991, allowing the state or private entities to acquire water rights for instream purposes. The Washington Water Trust, a private nonprofit organization, has leased and purchased water rights from primarily agricultural users to improve stream flows, reconnect migratory routes, and improve habitat for local fisheries. In 2000, the Washington Department of Ecology, the state's water regulatory authority, started a Water Rights Acquisition Program that acquires water rights from willing

sellers, mostly for stream flow augmentation to benefit endangered or threatened fish species.

- **Wyoming**: Wyoming lacks provisions that would allow the state or any private entity to lease water rights for instream flows. The state may purchase rights or receive donated water rights that could then be transferred to instream use; however, no acquisitions or donations have occurred.

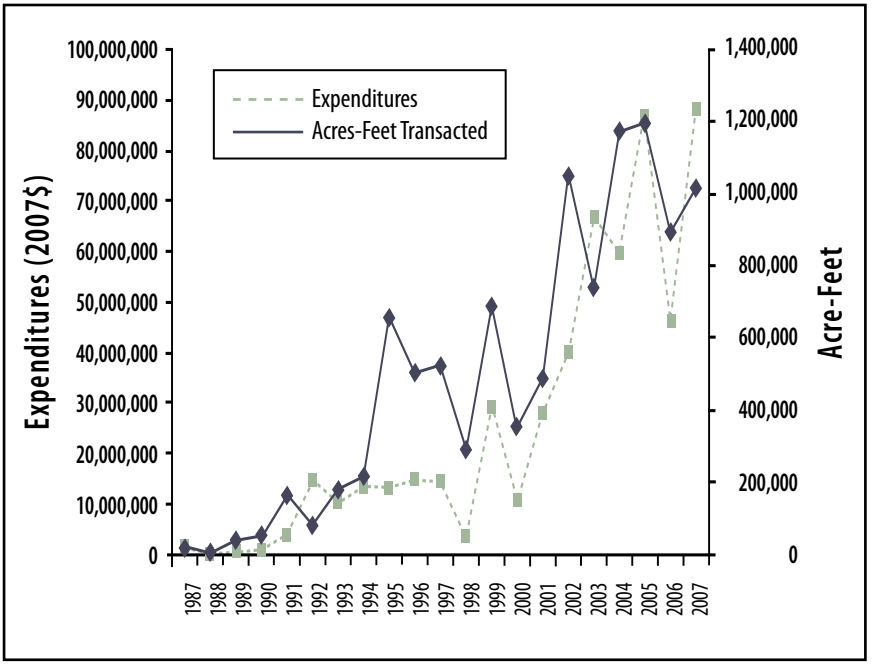
Voluntary Trades

Increasingly, demands for environmental and recreational flows are being met through voluntary trades that reallocate water into streams (Figure 1). Between 1987 and 2007, state, federal, and private entities restored more than ten million acre-feet[26] of water to streams through short- and long-term leases, donations, and permanent transfers. More than 2,800 transactions[27] were completed, exceeding a half-billion dollars in value (inflation adjusted).[28]

Despite progress, there remains stark variation among the western states in ability to buy, lease, or donate water rights for environmental or other purposes. In addition, where trades are permitted, the transaction costs involved can be substantial. As a consequence, water may remain in lower valued uses, incentives for improved water use efficiencies and conservation are diminished, and society bears unnecessary economic and environmental costs. Identification and a better understanding of the factors that impede markets are critical steps toward improving water allocation and restoring dewatered streams.

Between 1987 and 2007, state, federal, and private entities restored more than ten million acre-feet of water to streams through short- and long-term leases, donations, and permanent transfers.

Figure 1: Annual Instream Flow Transactions 1987–2007 for all Western States



Source: Transactional data were compiled by the author from a number of sources including state and federal agencies, private organizations, and the extant literature.

WHY NOT MORE MARKETS?

No western state governs instream flow rights and transfers in the same manner as traditional offstream water rights. Legal restrictions limit the role of private parties in acquiring water for non-traditional purposes. And states remain reluctant to move away from centralized control of instream flows. As a result, demands for flow restoration are still largely addressed, not through voluntary exchange among private interests, but through political means—a process that "is often slow, contentious, and expensive" (Sterne 1997, 206).

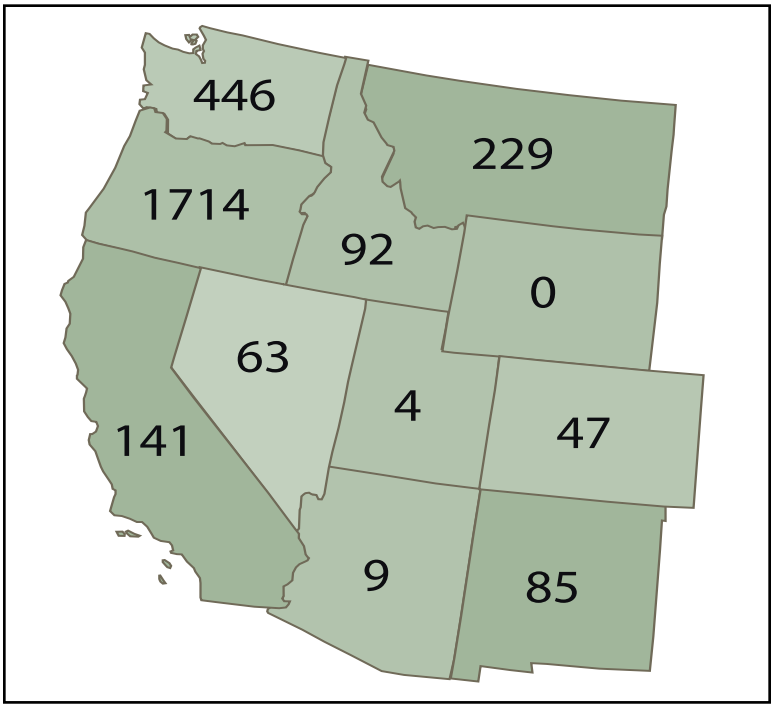
In addition to legal and institutional roadblocks, market expansion is impeded by poorly defined water rights, inadequate enforcement of rights, a lengthy and costly administrative process, regulatory uncertainty, and informational and cultural barriers. Consequently, voluntary transfers of water to instream purposes remain cumbersome and costly. These obstacles vary widely across states and the extent to which they may affect market activity within states. Figure 2 illustrates the differences among western states in the number of transactions made to enhance instream flows. Transactions are one measure to gauge the comparative success of state instream flow markets and, by extension, demonstrate how removing barriers may improve market activity and water allocation.[29]

Identification and a better understanding of the factors that impede markets are critical steps toward improving water allocation and restoring dewatered streams.

Transactions tend to be more common in states that permit and encourage private involvement, including Oregon, Washington, and Montana. By comparison, far fewer voluntary transactions have occurred in the other western states. The opportunity for private participation alone, however, is insufficient to explain market activity. Anyone in California may acquire water for instream uses, but few transactions in California are private. Similarly, Nevada permits any private entity to acquire and hold instream flow rights; however, strong competition for limited water resources and limited demands for instream flows has quelled market activity.

A review of current literature, statutes, and case studies, combined with interviews with state administrators, conservation advocates, and various market practitioners has identified additional barriers that complicate the progression and expansion of markets

Figure 2. Instream Flow Transactions 1987–2007



Source: Transactional data were compiled by the author from a number of sources including state and federal agencies, private organizations, and the extant literature.

for instream flows. Identification of these barriers illuminates the need for policy changes and improvements to the institutional environment governing water use and allocation in the West.

Legal Barriers

Historically, the most prominent legal barriers to instream flows were states' limited definitions of beneficial use and the laws prohibiting either new appropriations of instream flow rights or the transfer of existing consumptive rights to instream use. Today, all western states recognize certain instream uses as beneficial and no longer require water to be physically diverted

in order to constitute a legal water right. Definitions of beneficial instream uses, however, are more restrictive in some states than in others, limiting the opportunities to protect flows.

Washington, for example, recognizes a number of instream flow uses as beneficial, including fish and wildlife maintenance and enhancement, protection of game and birds, recreation, scenic, and all other uses compatible with the enjoyment of the public waters of the state.[30] On the other hand, Wyoming limits instream flows rights to the "minimum flow necessary" to "establish or maintain fisheries" (if the water is supplied from stored sources) and to "maintain or improve existing fisheries" (if from unappropriated waters). [31] As a comparison, imagine if a state law required all land to be used only for agriculture, urban, or industrial uses. Landowners would be in violation, and subject to losing their entitlement, if they altered their land use to provide environmental amenities, such as wildlife habitat, native grasses, wetlands, or forest cover. When states restrict water right holders from using water for whatever environmental or recreational purposes people support, fewer trades occur and fewer of those amenities will be provided.

Defining instream water as a beneficial use is a necessary legal condition for protecting stream flows, but it is not sufficient. Unlike markets for offstream water uses most states place restrictions on private acquisition and holdership of water rights if used for instream uses, irrespective of whether or not the state recognizes such uses as beneficial. For instance, Colorado, Idaho, and Wyoming prohibit private parties from holding an instream water right. Individuals may acquire offstream rights and convey them to the state with the intention of having their rights changed to instream use; however, there is no guarantee that stream flows will be maintained (see below). Utah limits acquisitions to leasing and only by specified private conservation organizations. Arizona,[32] California, Montana,[33] Nevada, and New Mexico[34] al-

When states restrict water right holders from using water for whatever environmental or recreational purposes people support, fewer trades occur and fewer of those amenities will be provided.

low any person to hold an instream flow right that was converted from an existing water right. Private parties may acquire consumptive water rights (whether through lease, purchase, or donation) and file for a temporary or permanent change of use to instream without relinquishing ownership to the state. Washington and Oregon permit private acquisitions, but once the rights are changed to instream use they are held in trust by the state. Ownership is restored to the water right holder upon termination of temporary conversions (leases or temporary donations). In addition, any private water right holder may temporarily or permanently donate all or a portion of unneeded consumptive water directly to the state without risk of forfeiting future use of the water, which would otherwise be subject to loss under the "use it or lose it" provision of the prior appropriation doctrine.

The leading arguments in opposition to private appropriation and ownership of instream rights originate from existing offstream users (Livingston and Miller 1986). Agricultural, municipal, and industrial users fear that instream appropriations will reduce potential development by limiting future supplies. "For many opponents, there is simply no desire to allow a new interest group to share a resource that historically has been controlled and managed for the benefit of a few" (Fort 2000, 159). Moreover, there is concern that the trading of water rights to uses other than for agricultural production can adversely affect local economies (Bourgeon, Easter, and Smith 2004; Hanak 2003). Others fear that instream flows will lead to greater scrutiny of their water rights and the potential of diminished

access to water. Because water left instream is easily diverted by other users, enforcement often requires greater monitoring of instream rights as well as existing offstream users to ensure flows are maintained. This situation can increase the possibility of disputes and claims against other water right holders.

These arguments are problematic. Assuming states extend the provisions set forth in the prior appropriation doctrine to instream users, the risk of injury to existing users is unrealistic. Under the rule of "no injury," the water rights of existing senior and junior water users should not be affected by any change to an existing right and, in the case of a new appropriation, no senior water users will be injured. Second, because the amount of water needed to adequately improve stream flows is often small, transfers are unlikely to adversely impact a local community. In fact, where the value of water instream exceeds traditional uses, the economic gains from trade may improve local economies through expansion in fishing, hunting, and recreational opportunities. Third, the potential for greater scrutiny of existing rights and claims against offstream users is real, but for the benefit of all legal water users. Only users who are diverting or using water illegally or in excess of their entitlements are at risk of loss. When water rights are well defined and enforced, existing users should benefit from the right to sell water for instream flows.

Instream flows are often viewed as a common property resource, in which exclusion of or contracting with all beneficiaries is prohibitively costly. As such, it is expected that instream flows would be underproduced if only provided by the private sector (Anderson and Johnson 1986). Moreover, in the context

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of markets and acquiring water for instream purposes, pricing of public resources can be difficult (Dellapenna 2005). Limiting the provision of stream flows to state agencies is, however, counter to the fundamentals of property rights inherent in the prior appropriation doctrine. Moreover, such limitations take allocation decisions out of the hands of water users—including those wishing to enhance environmental conditions—who bear the direct costs and reap the benefits of such decisions. Extending use rights of instream flows to private entities would be legislatively simple even though it is politically difficult. Codification of strong water rights vastly increases the pool of buyers and sellers (Boyd 2003) and, thereby, the opportunities to improve flows.

A look at historical transactions illustrates the benefits to removing barriers that limit private entities from providing instream flows. In states permitting private acquisitions (Washington, Oregon, Montana, Nevada, California, New Mexico), more than 2,100 transactions occurred between 1987 and 2007, compared to less than 130 in Colorado, Idaho, Utah, and Wyoming combined.

Even in states that prohibit private acquisitions, groups such as Trout Unlimited and the Colorado Water Trust report successes in restoring stream flows by working closely with state agencies and water right holders to facilitate voluntary transactions. In Idaho, Trout Unlimited worked with irrigators along Rainey Creek to obtain the first water donation to the Idaho Water Supply Bank for instream flow protection. In 2007, the Colorado Water Trust acquired consumptive water rights along a section of Hat Creek that provides critical habitat for local brook and brown trout

populations. The water rights were donated to the Colorado Water Conservation Board to be converted and held by the state as instream flow rights.

Abolishing restrictions on who may acquire or hold water for instream uses would increase the opportunities for trade and enhance stream flows. Private interests wanting to protect or improve flows could rely less on political channels so that demands could be met through voluntary transactions. Demands for environmental or recreational flows could then compete with offstream users in the same market setting. Water allocation would improve and economic gains would be recognized by water rights owners.

Through legislative reform, the same trading opportunities afforded to consumptive water users could be extended to instream flow users. One effective strategy to help overcome states' reluctance is a gradual shift from state control of instream water to allowing private parties to participate in acquisitions and retain ownership of the rights. Montana and Utah, for example, adopted pilot leasing programs that permit private entities to acquire water for certain instream applications, while the state maintains some control in that it may repeal the program if deemed unsuccessful. This has not been the case in Montana, which has extended the program and now permits private entities to, in effect, acquire water in perpetuity (removing the limit on the number of times a lease may be renewed). Utah's program is more restrictive, permitting only private entities such as Trout Unlimited to lease water for fish habitat. Despite limitations, this legislation is a significant move toward greater private involvement and is a reasonable template for more restrictive states such as Wyoming and Idaho.

Poorly Defined Rights

One of the most important constraints affecting the transferability of water rights and the associated costs, whether for

offstream or instream uses, is how clearly the rights are defined. In the context of instream flow trades, the benefits from better-defined water rights are clear. In Washington, for example, the Department of Ecology, which is the largest acquirer of water for instream uses in the state, contends that the transaction costs of pursuing trades of un-adjudicated rights can be so high that they exceed the ecological value of increased stream flows.[35]

As the value of water and economic gains from trade increases, whether for offstream or instream uses, the value of better defined rights increases (Anderson 2004; Brewer et al. 2007; Scarborough and Lund 2007). Buyers and sellers hire water consultants to speed the transfer process. Consultants research water rights to ensure the rights are defined and prepare necessary state forms. Just as when private property to land changes hands, experts bring parties together and handle the formal paperwork.

Enforcement

The nature of instream flows, compared to offstream uses, complicates enforcement. Once water is diverted for agricultural or municipal uses, other potential users are automatically excluded from it (with the exception of return flows). Environmental or recreational flows are defined by a specific flow and reach, but unless monitored and enforced, are not excludable from diversion by other users.

The likelihood that rights will be enforced depends in part on who the residual claimant to the water is. When the gains from ownership of water rights accrue directly to the user of those rights, any threat to entitlement is more likely to be disputed and enforced. For example, any reduction in an irrigator's access to entitled water directly affects profits. Similarly, an illegal or excessive diversion that reduces a rafting company's instream flow entitlement is likely to be disputed. Conversely, when water rights are acquired and held by the state for the

public, the state is neither the direct beneficiary nor user. Thus any injury to those rights is less likely to be enforced (Sax et al. 2000, 117), as evidenced by the few fines issued in Washington and Montana. The enforcement of state-held rights depends on the ability of the state to police itself on behalf of the public—an "unlikely prospect" (Pilz 2006).

Greater private involvement in instream flow markets improves the likelihood that stream flows will be enforced. Private parties monitor flows to ensure leased or purchased water remains instream. For instance, the Columbia Basin Water Transactions Program monitors flows on 90 percent of streams where it has acquired water rights for instream purposes (Hardner and Gullison 2007). New technologies that record stream flow data over time or in real-time are helping to reduce monitoring costs, while improving enforcement to ensure flows are maintained.

Until water rights are better defined, improved enforcement by state agencies is unlikely. States generally lack sufficient resources to expedite adjudications, transfers, and disputes, much less to ensure water right holders are using their entitlements and not more. Conversely, private entities are motivated by the benefits gained from improved flows. As a result, instream acquisitions are monitored and enforced. Putting instream flows in the hands of those who benefit can help ensure the intended goals are met, whether it is to restore the ecological integrity of salmon spawning habitat, provide sufficient water for recreation, or enhance the aesthetics of a free flowing stream.

Administrative Barriers

Trading water for any purpose can mean substantial administrative costs. Such costs can eliminate the incentives for improved water allocation. Before an existing diversionary water right may be converted to an instream right, it generally must

go through a formal change-of-use procedure with the state. The process is similar to transfers among consumptive water uses; however, in California, Montana, Colorado, and Utah, state fish and wildlife or environmental agencies are often involved in the process in addition to state water engineers or water courts. The process varies among states but typically includes: 1) an application filed to the state water regulatory agency; 2) state inspection of the water rights; 3) determination if third parties will be affected by the change; 4) public notice; 5) public comments and protests; 6) a hearing (if needed), and 7) approval or denial. Each transfer or change of use is unique as the timing, complexity, and transaction costs involved depend on the nature of the transfer, third-party disputes, the state's application process, and available resources to investigate and process requests.

One of the most time consuming and costly components of a transfer is defining the rights and the amount eligible for transfer. Historical use must be determined and often, from that amount, only the consumptive use portion may be transferred to instream. As stated previously, determining historical use can be a long process and subjective methodologies to determine consumptive use introduce added uncertainty. In Washington, for example, water rights holders would be far more likely to lease or sell water for instream use if they could simply trade paper water rights and avoid providing evidence of historical use.[36] Limiting trades to historical use or consumptive portion of the right, albeit costly and time consuming, reduces the risk of third party injury and enlargement of water rights.

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The inefficiencies in the existing transfer process are epitomized in the time it takes to complete a transaction. In Washington, instream flow

transactions, whether a lease or permanent purchase, can take more than a year; few are completed in less than six months. This stems from a lack of adequate resources to process the backlog of applications and settle disputes in a timely manner. In addition, the state lacks an easily accessible and current database of water rights, complicating the process of researching existing rights and identifying potentially affected third parties. Similarly, in Montana, if a change of use application is not disputed, the process can be completed in less than six months; however, few applications are approved at this pace. Problems in Montana include third-party disputes, inconsistencies in the application process, unclear recognition of certain uses of water instream as beneficial, and inconsistent methodologies to determine consumptive use portion of water rights.[37] Moreover, in Montana and other states, the regulatory environment governing transfers and changes is continually being modified, which complicates the application and approval process and creates uncertainty for the applicant, the courts, and state agencies.

In comparison, short-term leases and donations in Oregon may be completed in "as little" as four to eight weeks, with renewals processed even more quickly. Similarly, Colorado permits farmers to loan water for up to 120 days to the state Water Conservation Board for use instream. The transfer requires only approval from the state engineer, eliminating the lengthy process of going through a state water court. Such temporary loans may be approved in as little as a month, while longer term leases and purchases generally take more than six months to process. In California, short-term transfers (less than a year) are processed in as little as two to three months, though long-term or permanent change-of-use applications may take years to complete.

The approval process can be administratively cumbersome and costly to the applicant (Thomas 2005). When the state process is slow, people learn to work around it. To reduce transaction

costs and bypass the lengthy application and approval process, conservation groups may contract directly with landowners by entering into forbearance agreements. The landowner is compensated for reductions in water use or changes in the timing of use for the benefit of improved stream flows. The water right does not go through a change-of-use process nor is it filed with the state; rather, the agreement is strictly between the landowner and the demander of stream flows. Groups such as Montana Water Trust, Trout Unlimited, and Oregon Water Trust have had great success in providing needed stream flows for fish and wildlife on relatively short notice while establishing trust with consumptive water users who may be apprehensive about dealing with state agencies.

Information Barriers

Even before facing the difficulties and costs associated with poorly defined or enforced rights, and the legal and administrative process, demanders of instream flows must identify potential streams for restoration, locate willing sellers, and negotiate market prices. Immature markets lack multiple buyers and sellers, creating uncertainty about prices and making it harder to obtain the information needed to ensure all parties that the terms of trade are accurate.

Private entities and governmental agencies employ strategies to locate willing sellers and to negotiate prices for instream rights. One strategy is to offer a standing price for water and wait for willing sellers. Local water banks in Idaho make standing offers for water, which may then be leased to other users at a set price. The Bureau of Reclamation leases water from these banks to supply instream flows for endangered species. This strategy is effective when not targeting specific stream segments or tributaries. Private entities, however, typically must rely on direct negotiations with landowners or indirectly through local conservation and irrigation districts. The use of local and online bulletin boards, private

water consultants, and independent brokers has been effective in connecting buyers and sellers.

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Private entities have brokered nearly twice as many transactions as federal and state agencies combined. By working cooperatively with landowners and local interests, private groups build valuable relationships, educating water right holders about instream flows and the potential of economic gains through markets, while gaining valuable information about market prices and expanding the pool of potential traders.

Cultural Barriers

The institutional barriers tend to differ across states, but a common characteristic is a general apprehension about leasing or selling water back into streams. Traditional thought was that water was to be used only on land applications (Meyer 1993; Schoeningh 2002) and that leaving it in its natural course was considered wasteful (Reisner 1986, 12). This sentiment still exists. There is a general resistance among farmers and ranchers to move water outside of agricultural uses for fear of diminishing local economies (Natural Resources Law Center 1997; Miller 2000); although transfers to environmental uses are often viewed more favorably than urban transfers (Ise and Sunding 1998).

Convincing consumptive water users to sell or lease water for instream uses remains a barrier to improving stream flows through voluntary trades. Rather than viewing water as an asset or input to a production process, it is typically viewed as property that should not be traded or used for other purposes. As a consequence, significant premiums are often necessary to entice sellers. WestWater Research,[38] a leading water appraisal firm, estimates that a 50 to 100 percent premium over the agri-

cultural value may be necessary to entice sellers to move water away from its traditional use. Despite extensive negotiations, incentives such as cost-sharing agreements to improve water use efficiency, and market premiums for water, cultural apprehension may still limit transactions.

Water right transfers or changes in use, whether for instream or offstream uses, require state involvement. Throughout the West there is a general distrust of governmental entities when water rights are involved. This is particularly true when the acquiring entity is the state or federal government. Direct involvement by governmental agencies in water issues sparks fears of increased regulation and loss of control over private rights.

Understandably, after multiple generations of investing in the production of food and fiber on the arid landscape, the idea of shifting scarce water resources away from agriculture to protect fish and wildlife populations, sustain recreation activities, and restore aesthetic beauty may seem like a foreign concept. However, increased efforts to improve information about environmental flows, acquisition programs, and financial opportunities for landowners, whether cost sharing for improved irrigation equipment or compensation for selling or leasing water, are helping to improve the sentiment about water trading.

The most effective strategy to overcome social or cultural barriers is a bottom-up approach in which private demanders can negotiate directly with private right holders. Conservancy organizations have made significant progress in building relations with local landowners, irrigation and conservation districts, and ditch companies through cooperative, on-the-ground contracts. Forbearance agreements or temporary water rentals that do not directly involve state agencies are also ways in which skeptical landowners can experiment with instream flows. There is generally little or no risk to other water right holders, the process is efficient, and the economic gains are clear.

CONCLUSION

Western states have adopted various means of trading water for instream purposes. In no state, however, are transactions considered easy, nor are they governed in the same manner as traditional water use trades. Legal barriers in Idaho, Utah, Wyoming, Colorado, and New Mexico that place certain restrictions on private acquisitions or holding of instream flow rights leave demands unmet and water in undervalued uses. Where trades occur, the transaction costs are often high because of poorly defined and enforced water rights, ever changing transfer and regulatory processes, a lack of market information, and cultural and political values inconsistent with instream flow demands. As a consequence, economic gains and the incentives for trade and conservation are reduced.

Overcoming these barriers is an increasingly important challenge as populations and western economies continue to grow. With this growth comes increasing demands for environmental and recreational amenities. Efficient allocation of water among various instream and offstream uses is critical in the face of scarce water resources and changing demands. Regulatory efforts are insufficient and incapable of restoring or improving flows, while market trades have proven to be an effective and viable solution—especially where private demands can directly compete with other water uses. Removing barriers to trade will reduce transaction costs, promote more efficient water allocation among offstream and instream uses, create incentives for improved water use, and improve environmental quality.

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NOTES

1 States examined in this report include: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

2 Preceding California's statehood in 1850, much of the land claimed by miners fell under federal jurisdiction; however, there was little or no effective authority governing the allocation or protection of mining claims or water resources (See Umbeck 1977).

3 States appropriate large volumes of water to hydropower generation plants under the assumption that the use of water requires an actual diversion. However, the use of water for hydropower generation is non-consumptive and in effect an instream flow right (see, e.g., Anderson and Johnson 1986).

4 Although uncommon, an entitlement to use water may be diminished or eliminated without compensation under certain circumstances. For example, requirements of the federal Endangered Species Act supersede prior appropriation rights, thus water users may be prohibited from withdrawing water from streams or groundwater in order to protect species habitat. Similarly, the public trust doctrine maintains that states must protect waters for the enjoyment and use of the public. In *National Audubon Society v. Superior Court,* the court ruled the city of Los Angeles' water rights to be limited in order to preserve Mono Lake water levels (see, e.g., Libecap 2006).

5 States may also prohibit or limit transfers of water outside of the source water basin.

6 Similarly, only a small portion of the more than 165,000 claims submitted in Washington have been adjudicated and the state has no timeframe for completion. After nearly

two decades, Idaho recently completed the adjudication of more than 150,000 claims in the Snake River Basin. In 2006, the state began the adjudication process of an estimated 24,500 water rights in the state's northern watersheds. The process is expected to be completed by 2018; however, recent budget cuts, which have eliminated nearly half of their staff and opposition from water right holders who argue the process is too expensive, are expected to delay the process.

7 The "no injury" rule was implemented to protect existing right holders from potential losses resulting from a change or transfer of other water rights. When a transfer is initiated, a public announcement is made (usually in a local newspaper or other media), giving other right holders an opportunity to dispute the transfer. If other holders believe the transfer or change will affect their access to water, in quantity, quality or timing, they may protest the transfer.

8 Evapotranspiration is the sum of water lost through evaporation, primarily from soils, together with the water lost through plant transpiration—the process through which plants transpire water, especially through leaves.

9 Rankin Holmes, Project Manager, Montana Water Trust, telephone conversation, September 12, 2008.

10 As our understanding of the connection between groundwater and surface water improved, it has become increasingly common for states to require new groundwater withdrawals to be offset by increases to surface water. For example, a developer may be required to acquire surface water rights equal to (or in excess of) the amount of water that would be withdrawn from a new well.

11 An often cited example occurred in May of 2001, when the federal government, reversing a century of practice, cut water deliveries to farmers in the Klamath Basin in

Oregon. The water was instead allocated to maintain lake levels and stream flows for endangered sucker fish and coho salmon (Meiners and Kosnik 2003). Cases involving the public trust doctrine have been less common. Between 1997 and 2007, Slade (2008) identified only four public trust cases in which water rights were altered for the protection environmental flows.

12 In addition to excessive appropriations, groundwater pumping and changes in precipitation patterns over time have reduced the amount of water available to appropriators in many streams, in effect making the most junior water rights useless and many other rights unreliable.

13 Act of Feb. 9, 1915, ch. 36, 1915 Or. Laws 49, 49–50.

14 Idaho Code § 67–4301.

15 The term "minimum flows" is used somewhat generically as states vary in both the terms used to describe and the purposes for which they designate minimum flows. Montana uses the term "instream reservations"; Washington establishes "base flows," but, like other states will often refer to them as "minimum flows" or "minimum streamflows"; and Oregon uses the term "minimum perennial streamflows."

16 States have authorized administrative agencies to implement and/or interpret laws governing minimum flows. Depending on how the agency interprets the statute, regulation, or case law, it makes an administrative ruling on whether or not a stream section may be designated to minimum flows.

17 Administrative Rule of Montana 36.16.119.

18 Establishing minimum flows on streams currently lacking sufficient water for target species does not improve conditions since only the water not currently appropriated to other uses may be reserved instream. Therefore if the amount of water un-appropriated to other uses is

insufficient to provide adequate flows, protecting those flows is unlikely to alter the ecological health of the stream above its current condition.

19 In cases where streams are dewatered for only a short period of time or through a specific reach each year, altering the timing or location of diversions can restore or reconnect stream segments.

20 California Water Code § 1707(a)(1).

21 "Urgency changes" may be made in times of severe drought or water emergencies that require a timely transfer of water that would otherwise not be possible in time through the formal application process. California Water Code 1435 provides that "any permittee or licensee who has an urgent need to change a point of diversion, place of use, or purpose of use from that specified in the permit or license may petition for, and the board may issue, a conditional, temporary change order without complying with other procedures or provisions."

22 California maintains a complex mix of water rights including riparian, prior appropriative, reserved rights (water set aside by the federal government when it reserves land for the public domain) and pueblo rights (a municipal right based on Spanish and Mexican law). Moreover, California water rights are created and governed by various statutory, constitutional, and common laws, complicating the transfer process and introducing significant costs that often diminish or eliminate gains from smaller private transactions.

23 Colo. Rev. Stat. § 37–92–102(3).

24 Wood River Minimum Stream Flow, § 1136, Fifty-ninth Legislature, 1st session (2007).

25 Nev. Rev. Stat. § 533.345, 533.360 (2001).

26 An acre-foot of water is roughly 326,000 U.S. gallons (1,233 m^3)—a volume sufficient to cover one acre of land to a depth

of one foot.

27 Each year of a multi-year lease is considered a transaction. For instance, a three-year lease agreement entered into in 2004 would show up as a separate transaction in subsequent years 2005 and 2006 in terms of expenditures as well as water quantity restored instream. Often annual payments are made throughout the lease term, although leases may be paid for in full in the first year. Recording each year of a multi-year lease as a single transaction would yield 2,093 total transactions.

28 All instream flow acquisition costs and prices have been adjusted to reflect 2007 dollars, using the Western Urban Consumer Price Index.

29 These results should be interpreted with caution. There are other socio-economic factors—including, but not limited to, local water supplies and demand of instream and offstream water income, precipitation, opportunity costs of water for other uses, and population density—that may influence the institutional setting and the local market activity.

30 RCW 90.54.020(1), RCW 90.54.020(3)(a), RCW 90.22.010.

31 WS 41–3–1001. However, it is unclear to the author how designating existing flows ("un-appropriated waters") as instream rights can "improve" fisheries, considering there would be no change to the amount of water instream, only protection from future diversions.

32 Legally, any individual may change their water right to instream use; however, the process is administratively cumbersome and to date no transfers have occurred. Transactions to enhance instream flows have been limited to the acquisition of federal or state storage water.

33 Instream flow transfers are limited to renewable ten-year terms in Montana. However, there is no limit on the number of renewals, in essence creating the opportunity

for permanent transfers to instream.

34 New Mexico law does not explicitly preclude or permit transactions for instream flows. Unless denied by the State Engineer or challenged in court, any individual could conceivably lease or purchase existing consumptive water rights and convert them for environmental use while maintaining ownership of the rights.

35 Hedia Adelsman, Chair, Hydraulic Appeals Board, Washington Department of Ecology, telephone conversation, October 3, 2008.

36 Amanda Cronin, Project Manager, Washington Water Trust, telephone conversation, July 14, 2008.

37 Rankin Holmes, Project Manager, Montana Water Trust, telephone conversation, September 12, 2008.

38 www.waterexchange.com.

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