



ELSEVIER

Water Policy 1 (1998) 457–469

**Water
Policy**

www.elsevier.com/locate/watpol

Market transfers of water for environmental protection in the western United States

Clay Landry*

PERC (Political Economy Research Center), 502 S. 19th Ave., Suite 211, Bozeman, MT 59718, USA

Received 19 April 1999; received in revised form 19 August 1999; accepted 23 August 1999

Abstract

Buying and leasing water rights for environmental protection is becoming an important method for protecting river and stream flows in the western United States. The region has experienced an increasing number of market transfers of water to protect water quality and fish and wildlife habitat. From 1990 to 1997, more than US\$37 million was spent to lease 2 million acre-feet of water and US\$23.8 was spent to purchase 132,000 acre-feet of water for environmental protection. State and federal agencies are responsible for most of these market transfers, but there is increasing activity on the part of private organizations to acquire water for instream needs. This paper examines recent developments of instream flow marketing in the western United States. The paper reviews recent transfers and acquisitions programs and discusses the growing entrepreneurial efforts by private organizations to acquire water rights for instream use. Market information including price and quantity of water traded was collected from market participants. The average purchase and lease prices for the region are US\$397 and US\$30 per acre-foot, respectively. © 1999 Elsevier Science Ltd. All rights reserved.

1. Introduction

Free-flowing water plays a vital role in water protection in the western United States. The region has placed more attention on increasing stream flows to improve water quality and protect fish and wildlife habitat. In an attempt to comply with the Federal Clean Water Act, western states are identifying surface waters that do not meet water quality standards.

* Tel.: +1-406-587-9591; fax: +1-406-586-7555.

E-mail address: landry@perc.org (C. Landry)

Inadequate flow is a primary problem for many streams not meeting these standards. In addition, low flows are challenging recovery efforts for endangered fish species. Salmon in the Columbia River Basin and the silvery minnow in the Rio Grande River Basin are examples of two species that are struggling due to low flows. Many economists point to market transfers of water as a way to restore, improve and protect environmental quality (Anderson, 1983; Saliba & Bush, 1987).

This paper chronicles the development of water market transfers for environmental protection in the western United States from 1990 to 1997. Market information was collected from state and federal agencies and private organizations acquiring water, and a summary of these transactions is presented, including price and quantity data. The paper also discusses the emergence of private entrepreneurial efforts to acquire water rights for instream use. Concluding comments suggest that private organizations are providing effective stream flow protection with limited budgets.

1.1. Pricing system vs. property rights system of allocation

Two market-based systems, a pricing system and a property rights system, are used to allocate water and encourage efficient use. Both systems rely on prices as a way to move water to its highest valued use. However, price determination differs greatly between the two systems.

Under a pricing system, a central authority sets the market price. The price signals market participants to adjust their supply and demand for water accordingly. This approach assumes that a central authority has full information about supply and demand and is able to adjust prices as market conditions change. In practice, these authorities routinely fail to vary prices in response to changing economic conditions (Young, 1997).

Under the property rights system, water is allocated at a price determined by the free exchange of water rights either for a limited period of time (lease) or in perpetuity (purchase) (Lee & Jouravlev, 1998). Within this system no central authority sets price and other terms of transfers (Colby, 1990). Once property rights are established in water, and markets are introduced, transfers of rights occur whenever the net private benefits from trade are positive. Transferable property rights in water create economic incentives for those who have the best knowledge about the value of water in its intended use to allocate water to higher-valued uses. Trade continues until the marginal values are equal among water users. Hence, economic gains can be captured through transactions with limited bureaucratic intervention. Market prices emerge through the continuous exchange of property rights between buyers and sellers.

In the western United States, the price of water acquired for environmental protection is determined by the market exchange of water rights. The prior appropriation doctrine, the underlying tenet of water law in every western state, allocates water use through property rights¹. For more than a century, farmers and miners have traded water rights to meet growing and changing water needs (Michelsen, 1994). More recently, cities and municipal water

¹ The prior appropriation doctrine uses the principle of 'first in time, first in right', which means that the first person to put water to beneficial use is granted a right to continue that use without interference from those making subsequent uses.

providers have entered the market. For the most part, water rights markets have been limited to consumptive water uses. However, water markets in the western United States are making an important transformation. Market exchanges to provide free-flowing water to improve and protect the environmental quality of streams and rivers are taking place.

1.2. Previous research

Information about the number of transactions, quantity of water transferred and the types of sellers and buyers is important for understanding the structure and development of a water market (Michelsen, 1994). A limited number of studies have attempted to quantify information on the emerging water market for environmental protection. Colby (1990), one of the first studies to examine this sector, identified few examples of market transfers for environmental use and concluded that the market was very thin. Institutional constraints, transaction costs and the public good characteristics of stream flows were identified as contributing to the small number of transactions. Brown (1991) identified 15 acquisitions of instream flow rights in the western United States from 1987 to 1991. Lease prices ranged from US\$2/acre-foot to US\$7/acre-foot and purchase prices varied from US\$9/acre-foot to US\$14/acre-foot. Most acquisitions were from irrigators and were used to augment unusually low flows (Brown, 1991). Since these studies were conducted many legislative and policy changes have occurred to encourage market transfers.

One issue commonly raised is the impact of instream flow rights on other water users. At the heart of the matter is the fact that water is used and reused along a given water course. For most diversionary uses, only part of the water diverted is actually consumed, leaving the remaining portion as a return flow to the stream. The return flow is available to downstream users. Anderson and Johnson (1986) address this concern with a conceptual model that includes instream flow values on streams where existing water has been fully allocated to diversionary uses. They argue that the potential for return flow problems can be reduced if water rights are defined in terms of consumptive use, that is, the difference between the amount of water diverted and the amount of water consumed (Anderson & Johnson, 1986). Some western states, such as Washington, have followed this approach and limit instream flow right transfers to the consumptive portion of the existing water right.

1.3. Changes in state water policies create instream flow markets

Over the years states have recognized the social, economic and environmental importance of free-flowing water. Pressures to consider the value of free-flowing water and establish *instream flow rights* in state water policies increased dramatically during the 1960s and 1970s. To address environmental water needs, states initially relied on public action by reserving water from appropriation, establishing minimum stream flows by bureaucratic fiat, placing use restrictions on new water rights, or by issuing new water rights for instream use (Anderson & Snyder, 1997). However, these protection measures were implemented after much of the available water was appropriated by out of stream uses. Increasingly, states are considering market transfers as an option for protecting instream flows.

The Pacific Northwest region of the United States, including California, Idaho, Montana, Oregon and Washington, have encouraged market transfers for environmental protection by allowing public agencies and private individuals to acquire water rights for instream flows. Market development was prompted by several pieces of instream flow legislation, beginning in 1987, when Oregon adopted changes that allowed public and private entities to lease or purchase water rights and convert them to instream flow rights. In 1989, Montana approved legislation that created a temporary program to allow the Department of Fish, Wildlife and Parks to lease water rights for the purpose of maintaining or enhancing stream flows for the benefit of fisheries. Washington followed in 1991 by establishing a Trust Water Rights program, which allows voluntary water right transfers for instream needs. In that same year, California incorporated changes to its water code to allow water rights to be transferred for the purpose of preserving or enhancing wetlands habitat, fish and wildlife or recreation. One year later Idaho granted exceptions to its water banking statutes that make it possible for the US Bureau of Reclamation to lease water from the water banking program for instream use. In 1995, Montana reformed its water right leasing program to allow private groups to acquire water rights for instream flows. While each state has taken a slightly different approach, they all allow market forces to drive instream flow transfers.

The Rocky Mountain region is relying on public agencies to act in the marketplace. Colorado, Utah and Wyoming all require that instream flows rights be held by the state. In 1986, Colorado passed legislation that authorized the Water Conservation Board to acquire instream water rights through donations, leases or purchases. The board has never received funds for leases or purchases and has relied solely on donations as the primary means of acquiring water. In that same year, Utah adopted changes to its water code that allow the Division of Wildlife Resources to purchase water rights for the protection of fish and wildlife habitat and recreation opportunities. This privilege was extended to the Division of Parks in 1992. However, all purchases by both agencies must be approved by the state legislature. Wyoming also enacted changes to its water laws in 1986 that allow state agencies to acquire water rights to enhance stream flows. The agencies are required to seek approval of acquisitions from the state Water Resources Commission.

In the Southwest region, states have continually rejected legislation to allow for market transfers of water rights for environmental protection. Despite this, water markets for environmental protection have evolved through court decisions in Arizona, New Mexico and Nevada. An Arizona Court of Appeals decision found that a diversion of water is not necessary to establish a water right and that a water right could be established to provide flows for fish, wildlife and recreational purposes (*McClellan vs. Jantzen*, 1976). In a similar decision on diversions, a Nevada Supreme Court recognized water rights in that state for wildlife and recreational purposes (*Nevada vs. Morros*, 1988). In 1998, New Mexico became the last western state to recognize rights to free-flowing water. The New Mexico Attorney General issued an opinion that water rights can be issued for instream use (*New Mexico Attorney General*, 1998). Drawing on case law, the opinion is limited to the context of transferring existing water rights to instream flow rights and does not acknowledge new appropriations for instream use.



Fig. 1. Western US Water acquisitions, 1990–1997.

2. Instream flow market summary

Much of the recent activity in instream flow markets is driven by efforts to improve water quality and to restore flows for endangered fish species. Water sales for instream flow and environmental uses were reported in nine of the 11 western states (with Wyoming and Utah being the exceptions)² between 1990 and 1997 (Fig. 1). An estimated US\$61 million has been spent on leases and purchases of water for instream use during this period. Expenditures on water jumped significantly in 1992, when total expenditures for leases and purchases rose to more US\$9.6 million, about four times the amount spent the previous year (Fig. 2). This increase reflects the initiation of several federal and state acquisition programs — most notably, the San Joaquin Refuge water acquisition program funded by Central Valley Project Improvement Act and the New Mexico Interstate Stream Commission acquisition program prompted by the Pecos River Compact.

The total quantity of water leased, purchased, and donated also shows an upward trend (Fig. 2). Since 1990, more than 2 million acre-feet of water have been leased, 130,000 acre-feet purchased and 245,000 acre-feet donated. The quantity of water traded spiked in 1995, reaching a combined total of 600,000 acre-feet of water for leases, purchases, and donations.

² The absence of sales in Utah is particularly surprising since provisions in the Central Utah Completion Act of 1992 call for water acquisitions for instream use in the Provo and Strawberry Rivers (Gillilan & Brown, 1997).

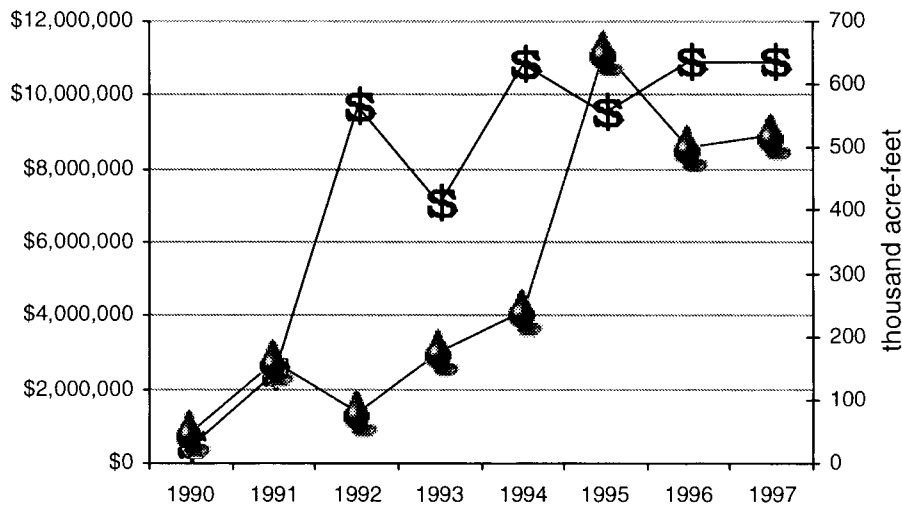


Fig. 2. Annual instream flow acquisitions, 1990–1997.

This rise marked the beginning of an aggressive campaign by the Bureau of Reclamation to lease water for endangered salmon species in the Columbia River Basin. The bureau's efforts in the region are driven by a 1995 Biological Opinion that calls on the agency to provide 427,000 acre-feet of water each year and stipulates that the water must be acquired from willing sellers (Rigby, 1997).

2.1. Federal agency acquisitions

The federal government accounted for over half of total market expenditures and is responsible for 70% of the total quantity acquired during the period 1990–1997 (see Table 1).

Table 1
Market activity by acquisition method, 1990–1997

	Federal	State	Private	Total
Lease expenditures (US\$)	27,653,410	10,095,861	96,482	37,845,754
Purchase expenditures (\$)	5,857,956	14,970,577	3,059,055	23,887,588
Total expenditures	33,511,366	25,066,438	3,155,537	61,733,342
Lease quantity (acre-feet)	1,595,088	385,255	22,083	2,002,426
Purchase quantity (acre-feet)	59,391	63,962	8979	132,333
Donation quantity (aft)	0	31,477	213,783	245,261
Total quantity (acre-feet)	1,654,479	480,695	244,846	2,380,021
No. of Leases	64	50	13	127
No. of Purchases	15	20	24	59
No. of Donations	0	10	50	60

Most of the federal government's acquisition responsibilities have been delegated to the Bureau of Reclamation, which has initiated acquisition programs in Idaho, California, Oregon and Washington.

The Bureau of Reclamation's water acquisition program in Idaho began in 1991 as part of salmon recovery efforts in the Snake River. Since 1991 the bureau has leased 1.09 million acre-feet and purchased 57,000 acre-feet (Rigby, 1997). In 1994, the agency expanded its acquisition efforts to California to improve flows in the Sacramento and San Joaquin Rivers. The California acquisition program, funded by the Central Valley Project Improvement Act, has leased over 420,000 acre-feet of water (US Bureau of Reclamation, 1997). In Washington, the bureau initiated a pilot leasing program in 1996 to restore flows in the Yakima River Basin. The program has leased a total of 7,000 acre-feet of water (US Bureau of Reclamation, 1998). The most recent addition to the bureau's acquisition efforts was in 1997 when it began a demonstration program in Oregon's Klamath River Basin. Since 1997, three leases have been completed, totaling 400 acre-feet (Davis, 1997).

The bureau is not the only federal agency active in the market. The US Fish and Wildlife Service (USFWS) is buying and leasing water in California and Colorado, but most of its efforts are focused on the Stillwater Wildlife Refuge in Nevada. This acquisition program was initiated in 1990 as a cooperative effort between the USFWS and the Nature Conservancy. The conservancy served as a broker by negotiating purchase agreements. The USFWS has since assumed the responsibilities of the acquisition program and expects to purchase an additional 55,000 acre-feet of water (US Fish and Wildlife Service, 1998).

2.2. State agency acquisitions

Commonly criticized for lacking money to implement water acquisition programs (Root, 1995; Sterne, 1997), states are now stepping up efforts to acquire water for instream needs. Between 1990 and 1997, state agencies across the western United States have spent US\$10 million to lease 385,000 acre-feet of water and US\$15 million to purchase 65,000 acre-feet. Montana, Nevada and New Mexico have some of the most active state acquisition programs. Created as a temporary program, Montana's leasing program allows the Department of Fish, Wildlife and Parks (DFWP) to lease water rights to maintain and enhance stream flows for fish. Since the program's inception in 1991, the DFWP has negotiated nine long-term leases and has paid between US\$1 and US\$50/acre-foot annually (Montana Fish, Wildlife & Parks, 1998)³. The Nevada Division of State Lands with the help of the Nature Conservancy has purchased more than 6000 acre-feet of water for the Carson Lake Refuge (Nevada Division of State Lands, 1998). The state has been working with the Conservancy since 1992 to secure a reliable water supply for the refuge. The New Mexico Interstate Stream Commission, one of the best funded state programs, has spent more than US\$18 million to lease and purchase just

³ Critics contend that the DFWP has not been as aggressive as it could be in implementing the program. They argue that the state has forgone several lease opportunities due to potential controversy and perceived political fall out (McKinney, 1991).

over 276,000 acre-feet of water to maintain flows and improve water quality in the Pecos River (New Mexico Interstate Stream Commission, 1998).

2.3. *Private sector acquisitions*

Private environmental organizations are becoming active in water markets. Since 1990, private groups have spent over US\$3.1 million to lease and purchase 22,000 and 9000 acre-feet of water, respectively. The Oregon Water Trust, the Washington Water Trust and Nevada's Great Basin Land and Water are three new groups using market techniques to acquire senior water rights and convert them into instream rights.

The Oregon Water Trust, established in 1993 uses a market-based approach to help maintain and restore surface water flows in the rivers and streams of Oregon. The trust works cooperatively with willing water users to acquire part, or all, of existing out-of-stream water rights. The group also works closely with community leaders, local watershed councils, government agencies, and a range of public interest groups to prioritize and implement its efforts. The trust is funded through grants and donations and is governed by a nine-member board of directors that reflects the diversity of water interests in Oregon.

Great Basin Land and Water, established in 1996, is helping implement the Truckee River Water Quality Settlement Agreement by purchasing US\$24 million of water rights on behalf of the cities of Reno-Sparks, Washoe County, the Pyramid Lake Paiute Tribe and the US Department of the Interior. The water rights will be dedicated to instreams flow in order to improve water quality during the summer months on the Truckee River. In addition, Great Basin Land and Water is purchasing water rights for the State of Nevada for the benefit of the Carson Lake wetlands in Fallon.

The Washington Water Trust, established in 1998, is restoring flows in Washington's rivers and streams by acquiring existing water rights and converting them to instream rights. Its focus is on market-based approaches to improve water quality, fisheries, recreation and other public values related to instream flows.

More traditional environmental organizations are also expanding their role. The Environmental Defense Fund (EDF), the Nature Conservancy and Trout Unlimited have participated in water acquisitions in Idaho, Colorado, Nevada, Oregon and Montana. EDF played a key role in organizing the first water right transfers in Washington. A 1994 EDF report, *Restoring the Yakima River's Environment*, recommended using voluntary transfers of water rights to help restore aquatic habitats in the Yakima and tributaries such as the Teanaway (EDF, 1996). The report served as the basis for the Bureau of Reclamation's pilot acquisition program in the Yakima. EDF, with help from the Confederated Tribes of Warm Springs Reservation, is also working with several irrigation districts in Oregon to lease conserved water for flow enhancement in the Deschutes River (EDF, 1996). Montana Trout Unlimited successfully negotiated the first private lease of a irrigation water right for instream flow in that state. The 10-year lease agreement provides an additional 460 acre-feet of water in Rock Creek, a small stream in western Montana. The Nature Conservancy of Montana was one of the first private organizations to get involved in leasing in Montana. In 1991, the conservancy helped raise money to establish the Montana Water Leasing Trust Fund (McKinney, 1991). At the time the fund was created the Department of Fish, Wildlife and

Parks was the only entity allowed to lease water rights for instream flows. The fund served as a repository for contributions from private individuals, foundations and corporations who wanted to help implement the leasing program. In Nevada, the Nature Conservancy is working as a broker for the USFWS and has spent over US\$1.5 million since 1990 to purchase water from farmers in the federal Newlands Project to leave instream flows in the Carson River (Anderson & Snyder, 1997).

2.4. Acquisition methods

A principal benefit of water markets is the numerous voluntary acquisition methods that can be used to reallocate water. A variety of lease, purchase and donation arrangements are possible depending on the needs of both the buyer and the seller. Annual leases have been the most common type of acquisition method to obtain instream flows. Between 1990 and 1997, a total of 127 leases were negotiated; 64 of these by the federal government. Most of these agreements were short-term contracts, typically limited to 1 year. State and private organizations completed 50 and 13 leases, respectively.

A lease of a water right involves the temporary sale of water, but not of the water right. Under a lease, the title of the water right remains with the original owner and at the end of the contract possession and control of the water is returned. Several lease formats are available beyond the standard annual and multiyear contracts. Dry-year options and split-season leases are two of the more creative contract arrangements. Dry-year options allow arrangements to be made ahead of time for access to water during drought (Colby, 1990)⁴. Split-season leases allow a portion of a water right to be used for irrigation early in the year, leaving the remaining portion of the right for instream use later in the summer. Option leases provide a way to protect fish, wildlife and recreational values without obligating significant funds and water when stream flows are adequate. Option leases have been used in a limited extent for instream flow transfers⁵. Although these option leases tend to be complicated, more agreements such as these may emerge as market participants gain more experience with instream flow transfers. Regardless of the form of lease contract, return flow and third party impairment issues are considered in the state administrative review process.

Purchases transfer the title of a water right, including all benefits, costs and obligations, in perpetuity. Purchases are usually a response to long-term changes in supply and demand conditions. Permanent purchases were less frequent in the instream flow sector than were leases. A total of 59 purchases were completed from 1990 to 1997. State and federal agencies negotiated 20 and 15 purchases, respectively.

In recent years donations have become an important method of acquiring water for instream

⁴ The holder of an option contract has the right to buy water at a specified price, termed the exercise price, from the seller of the option. The seller of the option guarantees future delivery under specified conditions and price. A premium in addition to the exercise price is paid in exchange for guaranteeing future delivery of water at a set price. The premium is usually paid in a lump sum at the onset of the option contract.

⁵ The Oregon Water Trust (1997) negotiated the first option lease with a farmer in the northeast part of the state. The 10-year contract provides 2.2 cubic feet per second of flow for six months of the year. When the option is exercised, the trust compensates the farmer for yield reductions due to decreased irrigation.

Table 2
Market price summary, 1990–1997 (US\$/acre-foot)

	Mean	S.D.	High	Low	<i>N</i>
Lease price	US\$29.84	US\$31.59	US\$214.10	US\$0.08	124
Purchase price	US\$397.47	US\$181.05	US\$850.00	US\$65.00	59
Lease quantity (acre-feet)	16,148.60	34,706.16	232,839.10	12.00	124
Purchase quantity (acre-feet)	2,242.94	7,531.80	44,900.00	11.27	59
<i>Regional lease prices</i>					
Pacific Northwest ^a	US\$29.95	US\$35.39	US\$214.10	US\$0.62	92
Southwest ^b	US\$35.22	US\$16.27	US\$51.49	US\$0.08	22
Rocky Mountains ^c	US\$17.16	US\$10.81	US\$43.00	US\$10.00	10
<i>Regional purchase prices</i>					
Pacific Northwest	US\$153.87	US\$124.48	US\$429.18	US\$65.00	7
Southwest	US\$420.03	US\$159.80	US\$850.00	US\$146.00	48
Rocky Mountains	US\$553.07	US\$154.26	US\$774.19	US\$416.35	4

^a The Pacific Northwest region includes California, Idaho, Montana, Oregon and Washington.

^b The Southwest region includes Arizona, Nevada and New Mexico.

^c The Rocky Mountain region includes Colorado, Utah and Wyoming.

flows by private organizations. Donations are a low-cost way of acquiring water for instream use⁶. Private groups negotiated 50 of the 60 donations that occurred between 1990 and 1997. Most donations occurred during 1995–1997. The Oregon Water Trust has been particularly successful with 46 of the 50 donations (Oregon Water Trust, 1998). Most of the donations were for small amounts of water ranging from 15 to 1000 acre-feet.

Several other groups have successfully acquired large donations of water. The largest donation from the Pittsburgh and Midway Coal Mining Company to the Nature Conservancy was for rights to about 200,000 acre-feet of water in the Gunnison River, Colorado (Anderson & Snyder, 1997). The Conservation Fund recently donated 2200 acre-feet of water valued at over a US\$1,000,000 to the Colorado Water Conservation Board, the only entity in Colorado that can hold instream flow rights. The water rights were apart of the Aspen Ranch, an 850-acre parcel that the Fund purchased in 1995 (Thomas, 1998).

2.5. Market prices

As with any local market, prices for water vary considerably depending on demand and supply and the duration of the right. Table 2 provides a regional summary of market prices for purchases and leases. Between 1990 and 1997, the average purchase price for instream water rights was approximately US\$400/acre-foot. The Rocky Mountain region exhibited the highest

⁶ There are some costs associated with donations, usually in the form of legal and transfer fees. Private organizations receiving donated water right typically pay these expenses. Donations also pose a cost to state and federal governments in the form of reduced tax revenues. Property owners that have donate water rights for instream flows have claimed tax deductions based on the market value of the rights (Crammond, 1995).

average purchase price at US\$553/acre-foot. However, the average is derived from a small number of purchases that all occurred in Colorado. The average purchase price in the Southwest region was US\$420/acre-foot. This region had the most purchases with 48 occurring between 1990 and 1997. The Pacific Northwest region had the lowest average purchase price at US\$153/acre-foot.

The highest purchase price, US\$850/acre-foot, was paid by the New Mexico Interstate Stream Commission in 1994 for water rights used to meet the Pecos River Compact (New Mexico Interstate Stream Commission, 1998). On the low end of the market, the Bureau of Reclamation paid US\$65/acre-foot in 1996 to buy back a water service contract for water stored in the Lucky Peak Reservoir, Idaho (Rigby, 1997).

The average lease price between 1990 and 1997 was US\$30/acre-foot annually. The Southwest region exhibited the highest average lease price at US\$35/acre-foot. The average lease price in the Pacific Northwest region was US\$30/acre-foot. This region experienced the most leases with 92 occurring between 1990 and 1997. The Rocky Mountain region had the lowest average lease price at US\$17/acre-foot.

The highest lease price, US\$214/acre-foot, was paid by Bureau of Reclamation in 1997, as a part of the water acquisition demonstration project in Oregon's Klamath Basin (Davis, 1997). The lease was negotiated with a farmer who had already planted wheat and was planning to irrigate the crop. The lowest lease price was US\$0.08/acre-foot paid by the New Mexico Interstate Stream Commission (New Mexico Interstate Stream Commission, 1998). Mississippi Potash Incorporated entered into this lease to avoid losing a portion of its rights due to lack of use. The lease ensures that the company's water rights are being used beneficially, avoiding the loss of these rights. The most unusual lease agreement was arranged by the Oregon Water Trust in 1994. The trust negotiated a lease with a cattle rancher to increase stream flows in exchange for 76 tons of hay forgone by reduced irrigation (Oregon Water Trust, 1996).

3. Conclusions

Market transfers of water are an important tool for environmental protection in the western United States. State and federal agencies are utilizing this tool and have spent a combined total of US\$37 million to lease 2 million acre-feet and US\$21 million to purchase 125,000 acre-feet of water. Most of this water was used to augment flows on major rivers throughout the western United States. The Columbia, the Snake, the Pecos and the Carson are just few of the rivers where state and federal governments have acquired water in an attempt to improve flows to protect water quality and endangered species. Yet the results of these efforts are uncertain, especially in the case of species recovery. Recently, the Idaho Department of Water Resources issued a report critical of the federal water acquisition program to aid juvenile Chinook salmon migration in the Snake River (Dreher, 1998). The report evaluates the impact of irrigation withdrawals on flows in the river, and the effects of flow augmentation on salmon migration. The study was unable to find a strong relationship between increased flows and improved salmon passage (Dreher, 1998). Though controversial, the report has provoked a intense political debate around the federal acquisition program, drawing into question whether large scale water purchases are cost effective in salmon recovery.

While state and federal governments are spending substantial sums of money and effort to increase flows on large rivers, most private organizations are focusing restoration efforts on tributary streams where small amounts of water can have significant effects. For example, most of the Oregon Water Trust's acquisitions are for amounts less than 500 acre-feet; often times that may represent the entire flow of the stream. In one partnership the trust spends approximately US\$6000 per year on hay to keep Buck Hollow, a small stream in central Oregon, from running dry. In exchange for the hay, the water right holder agrees to maintain flows at one cubic foot per second. Due to the additional flow, state fisheries' biologists estimate that the steelhead population can increase from the 30 spawning pairs in 1994 to as many as 500 pairs (Oregon Water Trust, 1996). This acquisition is an excellent example of how private organizations are making small budgets yield pronounced ecological benefits.

Discussions in state legislatures and the debates surround water transfers for environmental needs are much more pro-market today than they were 10 years ago. This change in attitude has paved the way for an increasing number of instream market transactions. However, markets may see only modest growth until several western states ease restrictions on private acquisitions of water rights for instream flows. Montana, Oregon, Washington and Nevada have all adopted changes that allow private organizations to participate in the market place. As a result, markets in these states are flourishing. Clearly, private organizations play an important role in creating opportunities for market transfers of water for environmental protection. In addition, the success of private organizations in these states demonstrate that private resources can and will be devoted to environmental goods such as instream flows and that the value of this resource is high enough to compete in the market place.

References

- Anderson, T. L. (1983). *Water crisis: ending the policy drought*. Washington, DC: Cato Institute.
- Anderson, T. L., & Johnson, R. N. (1986). The problem of instream flows. *Economic Inquiry*, XXIV, 535–554.
- Anderson, T. L., & Snyder, P. (1997). *Water markets: priming the invisible pump*. Washington, DC: Cato Institute.
- Brown, T. C. (1991). Water for wilderness areas: instream flow needs, protection and economic value. *Rivers*, 2(4), 311–325.
- Colby, B. G. (1990). Enhancing instream flow benefits in an era of water marketing. *Water Resources Research*, 26(6), 1113–1120.
- Davis, R. (1997). *Negotiations, Klamath Basin Water Acquisition Program*. Acquisition memo. US Bureau of Reclamation, Klamath Basin Area Office, Klamath Falls, OR, July 25.
- Dreher, K. J. (1998). *Competing for the mighty Columbia River: past, present and future: the role of interstate allocation*. Idaho Department of Water Resources.
- Environmental Defense Fund (1996). Farmers will leave more water in northwest rivers. In *EDF Letter*. September.
- Gillilan, D. M., & Brown, T. C. (1997). *Flow protection: seeking a balance in western water use*. Washington, DC: Island Press.
- Lee, T. R., & Jouravlev, A. S. (1998). *Prices, property and markets in water allocation*. Santiago, Chile: United Nations Economic Commission for Latin America and the Caribbean.
- McClellan vs. Jantzen (1976). 547, P2.D 454.
- McKinney, M. J. (1991). Leasing water for instream flows: the Montana experience. *Rivers*, 2(3), 247–254.
- Michelsen, A. M. (1994). Administrative, institutional and structural characteristics of an active water market. *Water Resources Bulletin*, 30(6), 971–982.
- Montana Fish, Wildlife and Parks (1998). *Features and costs of approved water leases*.

- Nevada Division of State Lands (1998). *Carson lake pasture water acquisitions*.
- Nevada vs. Morros (1988). 443, 493 P.2d 409.
- New Mexico Attorney General (1998). Opinion No. 98-01.
- New Mexico Interstate Stream Commission (1998). *Pecos river water rights lease and purchase summary*.
- Oregon Water Trust (1996). Water right holder profile. *Fish Flow News*. Spring newsletter.
- Oregon Water Trust (1997). *Fish Flow News*. Fall/Winter newsletter.
- Oregon Water Trust (1998). *Water rights acquisition summary*.
- Rigby, R. (1997). *Aquiring water for flow augmentation*, special report, US Bureau of Reclamation, Pacific Northwest Region, Boise, ID.
- Root, A. L. (1995). Challenges to instream flow protection in Oregon. *Rivers*, 5(3), 184–194.
- Saliba, B. C., & Bush, D. B. (1987). *Water markets in theory and practice: market transfers, water values and public policy*. Boulder, CO: Westview Press.
- Sterne, J. (1997). Instream rights & invisible hands: prospects for private instream water rights in the Northwest. Reprinted from *Environmental Law* 27(1). Northwestern School of Law of Lewis and Clark College, Portland, OR.
- Thomas, J. T. (1998). Water for people and fish. *High Country News* February 16.
- US Bureau of Reclamation (1997). *Annual work plan: Water Acquisition Program*. Mid-Pacific Region. September.
- US Bureau of Reclamation (1998). *Yakima River Basin Water Acquisition Program, Draft*. Yakima, WA: Yakima Basin Area Office.
- US Fish and Wildlife Service (1998). Water rights acquisitions for Lahontan Valley wetlands cumulative summary by calendar years. Stillwater National Wildlife Refuge. February.
- Young, M. (1997). Water rights: an ecological economics perspective. *Working Papers in Ecological Economics*, No. 9701, February, The Australian National University, Center for Resource and Environmental Studies, Ecological Economics Program.