"Throughout the West, water markets are evolving—
not always fast enough for the thirsty cities
and too quickly for some rural irrigators.
But the discussions . . . are much more
strongly pro-market today
than they were five years ago."
—*Water Strategist*
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INTRODUCTION

"We are running out of water!" This theme echoes through environmental publications and the popular press. For example:

- The Worldwatch Institute predicts that by the year 2025 "as many as 3 billion people could be living in countries experiencing water stress or chronic water scarcity." (Postel 1996, 58).

- "From the slums of Mexico to the overburdened farms of China, human populations are outstripping the limited stock of fresh water," says *Time* magazine. "Mankind is poisoning and exhausting the precious fluid that sustains all life" (Linden 1990, 58).

Are these fears legitimate?

Not if we are talking about the Earth's total demand and supply of water. While less than one per cent of the world's total water supply is fresh water available for human consumption, humans are only using between 38 percent and 64 percent of the readily available water (Rogers 1993, 28). This is true even though global water use has tripled since 1950 (Postel 1993, 68), and shot up 500–800 percent in the United States since the turn of the century (Kenski 1990, 5).

The problem is that clean water is not always in the right place at the right time. Many developing nations are water-scarce. In these poor countries, especially in Africa and the Middle East, available water is often contaminated. Diarrheal diseases, which kill more than 3 million people a year, mostly children, are often caused by unsanitary water (World Bank 1992, 49).

We contend that water markets are the solution to this problem. Here are a few examples of what water markets can do.

- In 1991, at the height of a drought in California, the state established an Emergency Drought Water Bank to purchase water from farmers at $125 per acre-foot[1] and sell it to municipal and other agricultural users for $175 per acre-foot. "By the end of June, 1991, the Drought Water Bank had purchased about 750,000 acre-feet of water. . . . It was a surprise to many people that such large quantities of water became available so quickly" (Rogers 1993, 9).

- Buck Hollow Creek near the Dalles, Oregon, had become a trickle of water in the summer due to irrigation, and the once-plentiful steelhead run had dwindled to 30 pairs or fewer. But in 1994, the newly formed Oregon Water Trust leased a local farmer's water rights and left the water flowing for fish. The price was $6,600, the cost of the 78 tons of hay the farmer would have grown had he irrigated his land.

- Chile's new constitution, passed in 1980 and modified in

> 1988, established secure, transferable water rights. According to Renato Schleyer (1994, 76): "The freedom to buy and sell or 'rent' water has given farmers greater flexibility to shift crops according to market demand. Efficiency in urban water and sewage services has been greatly increased with no impact on prices. . . ."

Unfortunately, these examples are exceptions in a world where public policy hinders the use of water markets. To understand why markets are so important, we must learn how we got to where we are today. In this paper, we will review the history of water allocation in the United States and see how a property-rights-based system became choked with government-imposed obstacles.

The good news is that we are on the brink of a revolution in water marketing. As our forthcoming book, *In Pursuit of Water Markets: Priming the Invisible Pump*, will show, water rights are coming full circle—once again returning to a system that allows trade (Anderson and Snyder 1997). In spite of many impediments, water is being more freely traded than in the past. Markets are providing agricultural and urban users with more reliable supplies and with an incentive to conserve, and are enabling environmentalists to purchase instream flows to protect fish and recreational opportunities.

A SHORT HISTORY OF STATE WATER LAW

Because water is a necessity of life, policy makers frequently assert that water is "different" from other commodities and that the government must allocate it. In fact, the opposite is true; because it is so precious, we cannot afford the misallocation that comes from political control. Nonetheless, regulations have been the norm in the West since formal government caught up with the frontier.

When miners and farmers first ventured onto the Great Plains, they tried to use the common law riparian doctrine carried over from England and familiar to them in the eastern United States.

According to this doctrine, water use is based on land ownership along streams and above groundwater aquifers. Each riparian owner has a right to reasonable use of water. One riparian owner cannot unreasonably impair the rights of other riparian owners to use water from the same source. (The meaning of "reasonable use" varies from case to case and state to state.)

The riparian system worked well where water was abundant but was ill-suited to the arid West where water was scarce and needed at mines and on fields some distance from the nearest stream.

Interestingly, Indian tribes living in the southwestern United States were among the early civilizations to adapt to this scarcity through private ownership. Although they collectively built dams and diversion canals, water delivered to the privately owned fields was privately owned (Anderson 1995a).

European settlers in the West established rights to water in the same way that land ownership was established—on the basis of "first-in-time, first-in-right." The first person to divert and use water from a stream acquired a right to the quantity of water used. Later claimants could establish rights to what was left, but in times of shortage, the "senior" users were entitled to take their full right from the stream before "junior" users could begin diverting theirs.

Early water rights established under this prior appropriation doctrine were not attached to any particular parcel of land. They could be bought, sold and transferred from one use to another so long as other water users were not harmed. During the Gold Rush, writes Barton Thompson (1996, 2) "miners frequently engaged in water transfers; as a claim played out or failed, the claim's owner would move or sell his related water rights." California courts confirmed such transfers, calling such rights "substantive and valuable property" that could be sold or "transferred like other property," and the courts of other states agreed.

Regulation Begins

As government followed the pioneers, however, so did regulation of western water rights. Elwood Mead, Wyoming's state engineer in the 1890s, was a leading proponent of state water

regulation. Mead considered water a public resource and feared that private ownership and water markets would lead to speculation and monopoly control. Mead drafted his mistrust of markets into Wyoming's water code by banning water transfers. Several states copied Wyoming's code, and at one point ten states banned water transfers (Thompson 1996, 3).[2]

Other restrictions on water rights arose as legislatures codified the prior appropriation doctrine. State laws required that water rights could only be established by diverting water from a stream. Claims to water left in the stream were not legitimate rights. Indeed, as recently as 1965, the Colorado supreme court ruled that a water right could not be claimed by leaving a flow of water in its natural stream to protect fish.[3] Today, the requirement to divert inhibits water transfers that could enhance environmental quality.

Another rule, "use-it-or-lose-it," requires appropriators to use their entire water right or risk forfeiting it. This rule was intended to encourage reasonable water use and discourage speculation. Now, it encourages waste.

The "salvaged water rule" also discourages conservation. Most western states do not allow users to keep or sell water that becomes surplus through conservation efforts such as installing more efficient irrigation systems, lining ditches, or repairing pipes. The rule is based on the notion that any water conserved now must have been wasted in the past and therefore belongs in the stream for anyone to appropriate. However, the prohibition removes any incentive for water users to improve their efficiency.

"Beneficial use" is another restriction on water rights. To establish a water right under most state laws, an appropriator must apply the diverted water to a beneficial use. States often specify uses considered beneficial. Maintaining instream flows was not recognized as a beneficial use until recent years, and at various times states have explicitly excluded certain uses. For example, Montana passed a statute in 1979 stating that water used in coal slurry pipelines was not a beneficial use.[4]

Some state regulations may be justified on the grounds that they prevent harms to other water users. When an upstream water diverter moves the diversion point, irrigates a different crop, or

changes the timing of use, downstream users may be affected. Water that formerly returned to the stream may now return at a different time or in a degraded condition. All western states have judicial or administrative procedures designed to protect other water users. Usually they allow transfers only if there is no injury to other water right holders.

But many regulations go beyond protecting third parties and interfere with efficient market allocations. Why shouldn't beneficial use be determined by what users are willing to pay for water? Why can't salvaged water revert to the owner, providing an incentive to invest in conservation? Getting outdated regulations out of the way is a must for improving water allocation through markets.

"Public Interest" Restrictions

States and counties have begun passing area-of-origin protection laws that prohibit or limit transfers of water outside its originating basin. Water transfers can be stopped in the name of protecting rural economies, culture, the environment, or the "public interest" generally.

Yet the extent of such harms is exaggerated. For example, because water is cheap, irrigators frequently apply it to marginally productive lands and crops. If water markets reduced agricultural production, it would probably be on these marginal lands. According to Wahl (1989, 188–90), agricultural water use could decline by between 15 percent and 20 percent through conservation without significant decreases in production. The Western Governors' Association Water Efficiency Working Group concluded (1987, 110) it "does not appear . . . that water markets present the threat to traditional lifestyles or natural areas that is feared."

Indeed, in southern California, the Metropolitan Water District signed an agreement under which it will acquire 106,000 acre-feet of water per year for 35 years from the Imperial Irrigation District. The water comes entirely from increases in water-use efficiency brought about through techniques such as lining irrigation canals or replacing them with pipe to reduce waste. By paying for the improvements, the Metropolitan Water District was able to acquire

the conserved water without reducing the number of acres irrigated within the Imperial Irrigation District (Reisner and Bates 1990).

Another force restricting water transfers is the public trust doctrine. This common-law doctrine, inherited by the United States from Great Britain, originally protected the public's interest in commerce, fishing, and navigation. However, it has been expanded beyond its traditional purposes to include environmental protection and recreation and has been used to divest long-held water rights.

In the 1983 Mono Lake case, for example, the California supreme court held that the state of California had a "public trust" responsibility to protect the environment even though its action would negate senior water rights held by the city of Los Angeles. The court decided that water diverted to Los Angeles should, instead, flow into Mono Lake to support aquatic life and birds. Los Angeles was not compensated for the loss of its water rights. The city was forced to spend $38 million each year to buy water from other sources (*Economist* 1994, 31).

In Montana, environmental groups asserted that the public trust doctrine should apply to streams and rivers that can be navigated recreationally. As a result, over 17,000 miles of Montana streams, most of which flow through private lands, were opened to public access. Farmers and ranchers were not happy with the decision, but they are even more fearful that the next step will be to use the public trust doctrine to mandate instream flows by reducing irrigation diversions.

The federal reserved rights doctrine has a similar effect on water rights. Since *Winters v. United States*,[5] a 1908 Supreme Court case, courts have upheld water rights claims for Indian reservations, national parks, national forests, and other federal lands. According to the doctrine, when the United States government reserved vast tracts of land in the West, it implicitly reserved to itself any unappropriated water that was needed to fulfill the purposes for which the land was set aside. Unfortunately, the *Winters* decision was vague about the quantity of water reserved. This has created a cloud on water rights claimed by individuals under state law.

FEDERAL WATER SUBSIDIES

If state regulations and court decisions were not enough to stifle water markets, federal water subsidies complete the task. Starting with the Reclamation Act of 1902, the federal government began to subsidize construction and operation of massive water storage and delivery projects. The primary goal of the reclamation program was to convert arid lands into farmland through irrigation, and the early twentieth-century Progressives pushed the program as a means to encourage settlement of the West. Irrigation would foster small family farms in keeping with the Jeffersonian ideal of an agrarian society (Mayhew and Gardner 1994). Given these goals, it is not surprising that the projects provided water at subsidized prices.

Though the Reclamation Act opened the floodgate for federal water projects, it took the New Deal to get the water flowing. Through the Tennessee Valley Authority, the Public Works Administration, and the Columbia Basin Project, the federal government built hundreds of dams for flood control, irrigation, and hydropower production. Agency budgets rose, jobs were created, and land values soared in regions where the water was delivered (Simmons 1994).

Initially, construction costs were to be repaid within ten years of completion by the recipients of the water. However, interest-free repayment schemes, together with deferrals and extensions of the repayment period—and a dramatic climb in interest rates in the 1970s and 1980s—raised the value of the subsidy to 95 percent of the actual costs. This subsidy has been valued at $19 billion (Wahl 1989, 27–39).[6] Typical examples of subsidies are shown in the table on page 9.

Because nearly all reclamation projects subsidize water users, they are extremely well suited to pork barrel politics. The cost of dams and canals is spread over all taxpayers, but the benefits—the wealth that comes when dry land becomes productive—are concentrated among specific interest groups. With the costs

diffused, the average taxpayer is not well informed about the projects. In contrast, irrigation interests are keenly aware and politically active. Politicians deliver water to these special interests at a fraction of the actual cost.

Good pork barrel water projects are not easy to get rid of. For example, President Carter tried unsuccessfully to stop funding a "hit list" of federal water projects in 1979. As recently as 1993, Congress authorized completion of the Central Utah Project (CUP), which includes a series of dams, aqueducts, tunnels, and canals designed to collect water from the Colorado River drainage in Utah and transport it to the Great Basin (Gardner 1995, 298). As the following chart shows the project will deliver water to irrigators at a cost of roughly $400 per acre-foot. The additional crops produced with the water make it worth about $30 per acre-foot to Utah farmers. But they will only pay $8 per acre-foot. In other words, farmers receiving water from the CUP will pay one-fiftieth of the cost of delivering the water they receive. Water *gushes uphill to politics*.

More Water Pork: The Central Utah Project

Source: Utah Foundation (1994, 298) and B. Delworth Gardner, Professor of Economics, Brigham Young University, Provo, Utah.

The situation is much the same throughout the world. Typically, revenues from agricultural users barely cover 10 to 20 percent of water project construction and operating costs (Repetto 1986, 37). Water prices from government irrigation projects in South Africa average only 30 percent of operating and maintenance costs and make no provision for interest and redemption of capital (South Africa 1986, 1.33). In light of these numbers it should not be surprising that farmers support politicians who push for subsidized water projects.

In addition to burdening the taxpayer, subsidized prices create an insatiable demand for water and encourage inefficient use. With low prices, users have no incentive to consider alternative technologies and lifestyle changes that would save water. Many irrigation systems use less than half of the water that flows into them. The rest runs off fields, carrying with it pesticides, herbicides, and soil nutrients; evaporates as it moves through open canals; or percolates into the ground through unlined ditches. Lands can become waterlogged as farmers apply generous amounts of water to their crops.

Irrigation drainage creates environmental problems, too. For years, California's Central Valley Project provided subsidized irrigation water to the Westlands Water District. The low price of the water encouraged farmers to irrigate even marginal lands. Wastewater from farming drained into the nearby Kesterson Wildlife Refuge via a drainage system built by the federal government (Wahl 1989, 198–205).

In 1983, the U.S. Fish and Wildlife Service noticed grotesque deformities in the birds and fish living in Kesterson. The toxic culprit was selenium that had been leached from the soil and carried to the refuge in the irrigation drainage from Westlands. In small doses, selenium is necessary for life, but it can be a deadly pollutant when concentrated, as it was at Kesterson.

Stopping the flow of wastewater into Kesterson by shutting off water to the irrigation district might have been a solution. But the politically powerful irrigators and the banks holding the debt on their farms would not stand for it. Taxpayer-funded pollution control costing millions of dollars was implemented to solve an

environmental problem caused by subsidies (Anderson 1995b, 269).

Federal water projects provide as much as one-third of all irrigation water in the West. But rights to water from federal projects are not easily tradable. Most reclamation laws fail to address water transfers, and, until recently, Bureau of Reclamation policy varied from region to region and project to project. Major inconsistencies raised questions, such as whether project water could be sold or leased at a profit, whether it could be transferred away from the lands to which it was originally assigned, and whether it could be used for nonirrigation purposes. In 1988, the bureau declared itself a "water market facilitator" and outlined procedures to govern transfers of federally supplied water. However, market activity in federal water has not increased significantly, primarily because the federal reclamation laws remain unclear (Wahl 1989).

PRICES ARE GOING UP

Despite all the limits on water transfers, there are growing pressures for change. As current fiscal and environmental constraints make it more difficult for governments to find new sources of supply, government agencies are being forced to consider raising water prices to encourage conservation. The evidence is strong that both urban and agricultural water users change their behavior in response to changing prices. For example:

- In the mid- to late 1970s, Tucson, Arizona, reduced its average peak daily demand by 20 percent, using price increases and voluntary conservation (Tucson Water Department 1996).

- Economists Bruce Beattie and H. R. Foster (1980, 444–45) studied six regions of the U.S. and found that a 10 percent increase in the price of urban residential water reduced consumption between 3.75 percent and 12.63 percent.

- Recent studies have found that a 10 percent increase in water prices will cause agriculture to reduce its water consumption by four to seven percent (Bay Area Economic Forum 1991, 14).

- In 1989, the California State Water Resources Control Board found that Central Valley cotton growers who purchased federal water from the Central Valley Project used 20 percent less water and produced 20 percent more output than did nearby growers who received their water at no cost under senior water rights (Zilberman, MacDougall and Shah 1994, 130).

- From 1985 to 1995, the price of water delivered to farmers in California's Westlands Water District[7] rose from an average of $16.25 per acre-foot to $58.11. This was also a period when water supplies to the district fell due to drought and environmental regulations. Farmers responded by fallowing all but their best lands, growing crops that yielded higher returns, and installing drip irrigation systems. Low-paying crops such as safflower, barley, field corn, rice and sorghum disappeared in favor of fruit and vegetables such as tomatoes, lettuce, garlic, onions, asparagus, melons, sweet corn, grapes and almonds (Clemings 1996; Westlands Water District 1994).

By motivating farmers to cut their consumption, higher water prices would free up irrigation water for municipal and other users. Transferring just 5 percent of agricultural water to municipal uses would meet the demands of urban areas in the western United States for the next 25 years (Spencer 1992, 70). Higher water prices would also reduce the demand to build costly supply projects and delivery systems and would encourage private, profit-making firms to enter the water supply industry, taking the burden off the public treasury.

THE TREND TOWARD WATER MARKETS

Higher prices dictated by water bureaucracies will help us solve water problems, but the real solution lies in unshackling water rights to allow more trading. In a growing number of cases, markets are being liberated from burdensome restrictions.

On the Farm

Irrigators have been trading water among themselves for years, both formally and informally. Many irrigation districts and mutual ditch companies have active internal markets, and trading even occurs in some districts supplied with federal water. Members of the Westlands Water District in California, for example, negotiated roughly 4,500 transfers during 1990–91 alone. In March 1996, Westlands introduced an electronic bulletin board system that enables farmers to buy and sell annual entitlements to federal water using a home computer and modem. Westlands hopes the bulletin board will expedite transfers, reduce paperwork and help farmers respond to volatile weather and market conditions.

Perhaps the best-established market for federal water operates in the Northern Colorado Water Conservancy District near Fort Collins, Colorado. Annual entitlements within the district are freely transferable. Some 30 percent of the water delivered to the district by the Colorado-Big Thompson reclamation project moves through the district's rental market each year, with rental prices ranging from $5 to $7 per acre-foot (Wahl 1989, 135–36; *Water Strategist* 1996).

Water banks are emerging as an important tool for facilitating water transfers. These banks are generally operated by a government entity and serve as intermediaries between buyers and sellers. Water users with excess water may deposit some or all of it in the bank for rental by other users. The bank often sets the price, timing, eligibility of water rights, and eligibility of recipients (MacDonnell et al. 1994, 1–4).

Water banks offer several benefits. First, they make trades easier by standardizing the transfer process and relaxing regulatory hurdles. Because banks are government-sanctioned and because they set prices, often not allowing profit, they are more politically acceptable than pure markets. Water banks even shun the idea of buying and selling by referring to bank transactions as deposits and withdrawals (Thompson 1996, 10).

Idaho's water bank has been in existence since 1979, and several hundred thousand acre-feet of water change hands each year. In 1991, the California Drought Water Bank purchased 800,000 acre-feet of water for $125 per acre-foot and sold half of it for $175 per acre-foot. The remainder went into the state water project. These transactions generated net benefits of $91 million (MacDonnell et al. 1994, 2–45; Thompson 1996, 8–9). The success of the drought bank led California to use it again in 1992 and 1994 and to consider establishing a permanent State Drought Water Bank.

In the Cities

In addition to trades among irrigators, water is increasingly being traded between agricultural and urban users.

- Utah's residential building boom has given rise to an active market in water rights. Cities are requiring builders to prove they own adequate water rights to serve the homes they plan to build before construction can begin. This has sent the value of water rights skyrocketing. Shares of water rights held by ditch companies are selling for as much as $3,200 per unit, a fourfold increase since early 1993. The high cost of water is leading some towns to install two pipelines to each home, one carrying drinking water, the other untreated water for lawns and gardens (*U.S. Water News* 1994).

- Following passage of a 1980 law in Arizona that made groundwater freely transferable, the cities of Phoenix,

Tucson, Mesa and Scottsdale acquired more than 50,000 acres of farmland. The goal is to retire the fields and pump the water to households.

- Along Colorado's front range, towns and cities have been buying water rights from ditch companies and irrigation districts and transferring the water to municipal lines.

- In Nevada, municipalities have been buying water rights to secure future development. Las Vegas has a standing offer to purchase water rights for $1,000 per acre-foot (Steinhart 1990, 42).

- In the mid-1980s, American Western Development, Inc., a consortium of investors, bought the 155,000-acre Baca Ranch in Colorado's San Luis Valley with the goal of pumping some of the valley's vast supply of groundwater to Denver and Colorado Springs. The $600 million plan was foiled, however, when the courts forbade the exports on the grounds that other water users in the valley would be harmed. After spending $30 million on the project, the consortium sold the ranch for $13 million. But the story does not end there. The ranch's new owner, Gary Boyce, is considering selling surface water rights, estimated at more than 50,000 acre-feet, downstream (Steinhart 1990, 40).

"Increasingly, water is finding new owners," writes Steinhart (1990, 44). "A study by researchers at the University of Arizona found that in the last twelve years there were about 6,000 transactions in Utah, 1,455 in New Mexico, 1,500 in Colorado."

For the Fish

Because western water rights evolved to allow diversion for mining and agriculture, instream flows suffered in many places. Throughout the West, it is common to see dry streambeds adjacent

to lush green irrigated fields. Until recently, the only option to restore water has been to go to court using the public trust doctrine or to the legislature seeking minimum stream flows. Now, however, some entrepreneurs are making the environmental benefits of water marketing more visible.

- The Oregon Water Trust, which leased a rancher's water rights on Buck Hollow Creek in Oregon, is expanding its reach. The trust hopes to negotiate at least 20 agreements each year, including several long-term leases and outright purchases. According to rancher Rocky Webb, "By working with the Oregon Water Trust, I can protect a stream I care a lot about and continue to raise cattle and make a living here like my family has for years" (Middaugh 1995).

- The Environmental Defense Fund (EDF) has been negotiating to keep water in the Columbia River basin streams to protect salmon and steelhead. In 1993, EDF's Zach Willey engineered a three-year lease option between the Bonneville Power Administration (BPA) and Skyline Farms of Ontario, Oregon. The BPA was granted the option to lease up to 16,000 acre-feet of water from Skyline for instream use (Middaugh 1995). In 1996, EDF negotiated a transfer of irrigation water rights from farmers in the Yakima River Basin and the BPA to instream flows in the Teanaway River (*EDF Letter* 1996, 1).

Across the Oceans

The trend toward water marketing has not been limited to the United States. Australian states, led by South Australia, New South Wales, and Victoria, have begun allowing permanent transfers of water rights through markets. As is often the case, informal structures were evolving before the government codified water trading in the 1980s. Farmers transferred water entitlements through "duality of ownership" or "licence stacking." That is, they purchased two parcels of land and transferred the water entitlement

from one to the other.

Sturgess and Wright (1993, 23–24) report that water transfers within the Murray-Darling River Basin, which stretches 2,530 kilometers (1,571 miles) through eastern Australia, dramatically increased farmers' income. In the 1988–89 growing season, they note, 280 transfers occurred, increasing rural income by $5.6 million. Two years later, the addition to income was $10 million. (During the drought of 1987–88, the figure was even higher —$17 million.) "If benefits of this scale can be obtained by a system of water transfers circumscribed by regional barriers, the benefits that would flow from the redefinition of water property rights to allow the free transfer of water between regions . . . would be greater still," they write.

European countries are not as far along with water trading, but they are experimenting with higher water fees to encourage conservation and reduce pollution. In Germany, taxes and water charges are being used to induce users to switch from groundwater to surface water supplies. In France's Artois-Picardie River basin, water charges reduced overall consumption by 15 percent and industrial consumption by 55 percent between 1970 and 1989. Assessments on effluent discharges also reduced water pollution. "One of the major merits of this system is that the concept of water having an economic value has now become generally accepted," writes Mark Tuddenham (1995, 213). These systems should not be confused with actual water markets where willing buyers and willing sellers exchange water rights, but they indicate a recognition that prices matter.

Chile, known for applying market solutions to a variety of social problems, implemented a market-oriented water policy in 1974. A new constitution reversed the expropriation of water rights the government had started in 1966 and established secure, transferable water rights. Individuals and enterprises can buy or lease water, and they do. Renato Schleyer (1994, 76) concludes: "One of the greatest achievements of Chile's water policy is allowing cities to buy water without having to buy land or expropriate water." In this setting, gains from trade promote efficiency and cooperation rather than acrimony.

INTERBASIN WATER MARKETING

The difficulties of trading water between individuals within a water basin pale in comparison to interbasin and cross-boundary transfers. In the debates over the North American Free Trade Agreement, Canadians were especially concerned about water transfers to the United States, and ultimately the trade agreement did not free up water markets. But since 47 percent of the earth's land mass straddles international water basins and since water shortages do not respect political boundaries, the pressure for interbasin and cross-border transfers will continue.

Interest in interstate trades is emerging in the southwestern United States. In 1994, Arizona, California, and Nevada began discussing a water bank for the lower basin of the Colorado River. At the root of the water bank discussions is the fact that California and Nevada face shortages, while Arizona is awash in subsidized Colorado River water from the Central Arizona Project (CAP).[8] CAP delivers water to its users at rates that are subsidized but still above the cost of alternative sources, chiefly groundwater. As a result, CAP is not being used to capacity. In 1994, CAP delivered less than 55 percent of the 1.5 million acre-feet of Colorado River water available to the state. Moreover, the project loses more than $24 million per year.

In contrast, California and Nevada use all their share of the Colorado River and then some. The two states have benefitted from Arizona's underuse of the Colorado for years, because unused water left in the river is free for the taking by the two downstream states. Recognizing that this source will become less secure as Arizona's use increases, California and Nevada are on the lookout for secure water supplies to meet growing demands.

CAP's fiscal losses plus water scarcity in California and Nevada are moving these states toward interstate water marketing. Prices in California and Nevada currently range between $150 per acre-foot for water from irrigation districts and $1,600 per acre-foot for desalination (Fuller 1996, 114). If CAP received $140 per acre-foot for its water, its losses would be covered. These vast differences in prices suggest substantial potential gains from

interstate water trading.

Regional water trading in Australia is already taking place. The first temporary intervalley water transfer occurred in 1992. It involved a five-year lease of 7,982 acre-feet from a property on the Murrumbidgee River in New South Wales to a cotton farm on the Lower Darling River in South Australia. Although local farmers feared that a permanent transfer would damage the local economy, a lease was acceptable because it would increase the flow on the Murray River and because it could increase net wealth by as much as $2 million. "Since then, temporary interbasin transfers have expanded considerably," writes Gary Sturgess (1996, 135). From July 1, 1994, to June 30, 1995, a net 87,000 acre-feet of water was traded out of the Murrumbidgee. The Murray-Darling Basin Commission, which was originally formed in 1917 to build and maintain physical infrastructure on the Murray River, today is managing water trades and serving as a regional federation (Sturgess 1996).

James Huffman has proposed a similar "North American water marketing federation" to deal with water issues between the United States and Canada, and the United States and Mexico. As Huffman (1994, 158) describes it, such a federation would enforce water rights "free from the distorting influence of nationalism, provincialism and political competition." It could soften the present resistance to cross-border transfers between Canada and the United States.

The resistance to cross-border trading between the Canada and the United States stems from the fact that most proposals call for massive projects to deliver water from remote regions of Canada to populated areas of the United States. Such grandiose political schemes frighten the Canadians, who fear that low prices will create an insatiable thirst south of the border. Because the water changes hands between governments instead of individuals, water users in the United States would not have to pay the enormous costs of the project directly; the real cost of the water would be hidden in taxes. In contrast, citizens of the "selling" country—Canadians—would gain little or nothing and potentially lose environmental benefits.

True water marketing across borders would require that these

subsidies be eliminated so that buyers would pay the full cost of the water, and sellers would be compensated for the water they give up. A water federation of the kind proposed by Huffman would help clarify water rights and facilitate trades between individual willing sellers and willing buyers as in the Murray-Darling example. "By shifting water use decisions from the countries to the actual water users," says Huffman (1994, 157), "a transboundary water market will change the focus from the acquisition and exercise of political influence to the greatest productivity of the water."

CONCLUSION

Gloom-and-doom predictions of future water crises will probably always plague us. Fortunately, predictions of natural resource shortages are often wrong because they ignore the impact of market forces on supply and demand. Despite predictions that we will run out of everything from copper to tungsten and that we will have shortages of everything from energy to food, markets—imperfect as they may be—have worked well to avert crises. Higher prices induce suppliers to find new sources of supply and users to conserve and search for substitutes.

Water allocation is no exception. If governments send the wrong signals to suppliers and users by subsidizing water storage and delivery, exponential growth in consumption will inevitably run into environmental and fiscal constraints. But if progress toward greater reliance on markets continues, water supplies and efficiency will increase as users trade with one another, and consumption will be tamed by higher prices.

Today in the western United States, water rights have come full circle. From private property rights freely transferable like any other property on the western frontier, they became public rights governed by legislatures and courts. Now they are becoming tradable property rights once again. States and the federal government, recognizing the practicality of markets for reallocating water, are taking steps to liberate water rights from burdensome rules and regulations. Although the "water is public" and "water is unique"

paradigms remain strong, irrigators, environmentalists, urban dwellers, and other water users are overcoming obstacles to markets with innovative arrangements involving voluntary transactions.

NOTES

1. An acre-foot is the amount of water necessary to cover an acre of land one foot deep, approximately 326,000 gallons.
2. Today all ten states have either repealed these bans or riddled them with exceptions (Thompson 1996, 3).
3. *Colorado River Water Conservation District v. Rocky Mountain Power Company*, 406 Pacific Reporter 2d 798, 800 (1965).
4. The law, Mont. Code Ann. § 85-2-104, was repealed in 1985, most likely in response to *Sporhase v. Nebraska ex rel. Douglas*, 458 U.S. 941, 102 S.Ct. 3456, 73 L.Ed.2d 1254 (1982), in which the United States Supreme Court held that the Commerce Clause generally prohibits states from discriminating against other states in their water allocation.
5. 207 U.S. 564, 28 S.Ct. 207, 52 L.Ed. 340 (1908).
6. The irrigation subsidy provided by the federal reclamation program is not limited to free interest on repayment of project construction costs. Although most projects are operated for irrigation purposes, operation and maintenance costs are subsidized by other project uses, primarily hydropower. Significant amounts of hydropower generated by reclamation projects are dedicated to pumping project water for irrigation. Hydropower is provided at a very low charge, and revenues from hydropower are even used to meet portions of irrigators' repayment obligations (Wahl 1989, 27 and 46).
7. Westlands is the nation's largest irrigation district. It is about the same size as Rhode Island, covering nearly 1,000 square miles in western Fresno and King counties in California. Westlands was formed in 1952 upon petition of farmers who urgently needed a surface water supply to supplement the area's groundwater, which was being overdrawn. Westlands delivers water from the Bureau

of Reclamation's Central Valley Project (Westlands Water District 1995).

8. CAP consists of dams, pumps and 336 miles of concrete-lined canals designed to divert 1.5 million acre-feet of Colorado River water and transport it 2,400 feet uphill to southeastern Arizona, near Tucson. The project was begun in 1968 and declared substantially complete in 1993 (Fuller 1996, 102).

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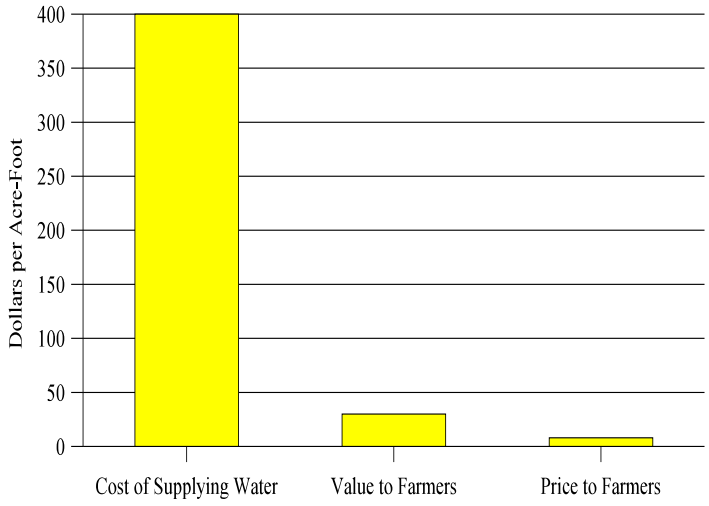
400
350
300
250
200
150
100
50
0
Dollars per Acre-Foot
Cost of Supplying Water
Value to Farmers
Price to Farmers