

# [***COMMENTARY: Protecting Public Values in a Water Market Setting: Improving Water Markets to Increase Economic Efficiency and Equity***](https://advance.lexis.com/api/document?collection=analytical-materials&id=urn:contentItem:42FS-2W30-00C3-W0XV-00000-00&context=1516831)

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**Text**

**[\*357]** **I. THE IMPORTANCE OF FLEXIBLE REALLOCATION OF EXISTING WATER SUPPLIES**

As urban areas, industry, and recreational and environmental uses of water expand, the issue of reallocation of existing supplies of water expands with them. Indeed, in light of the high economic and environmental costs of developing new water supplies, reallocation may be a necessary condition for further economic development of semi-arid **[\*358]** regions. [[1]](#footnote-2)1

This article focuses on the potential usefulness of extended water markets in which public values are adequately protected. It will concentrate on the issues of economic efficiency and fairness of water markets in regions that have adopted the appropriations doctrine, typically semi-arid regions where irrigated agriculture accounts for a large part of consumptive use.

The concept of economic efficiency refers to allocating scarce resources to maximize the net value of all useful products and services, marketed or non-marketed. [[2]](#footnote-3)2 At the individual project or policy change level, economic efficiency is reflected in a cost-benefit analysis that calculates the present values of marketed and non-marketed outputs and costs. [[3]](#footnote-4)3

The definition of "fairness" or "equity" is far more subjective. However, the public places great weight on some perception of equity in judging programs or projects. No matter how one defines equity, the distribution of benefits and costs across affected parties can be estimated as part of the cost-benefit analysis. This distributional analysis is especially important in designing policies and projects aimed at disadvantaged groups. In the longer term, the perceived fairness of the distribution of benefits and costs can affect the economic efficiency of projects through public reactions and project participation. [[4]](#footnote-5)4

Markets provide flexible and voluntary ways of reallocating resources under the right circumstances, therefore, water markets have been strongly advocated for many years. [[5]](#footnote-6)5 The major advantages of water markets over other methods of allocation are: (1) they provide for flexible reallocation **[\*359]** over time in response to economic, demographic, and social-value changes; (2) they involve only "willing seller-willing buyer" transactions; (3) due to the nature of "willing seller-willing buyer" transactions, they provide security of tenure of property rights; (4) by providing market evidence of the value of water, they continually confront the water user with the real "opportunity cost" of the water being used, regardless of the often-distorted prices charged by water distribution agencies; and (5) the transaction costs of market transfers can be kept low under the right circumstances. [[6]](#footnote-7)6

Examples of functioning water markets are found in the 100-year history of water rights trading in ***Colorado***. [[7]](#footnote-8)7 A particularly interesting and well-known example is found in the Northern ***Colorado*** Water Conservancy District of ***Colorado*** ("NCWCD"). [[8]](#footnote-9)8 The ***Colorado***-Big Thompson Project, a water project that the Bureau of Reclamation began in 1937 and completed in 1957, delivers water acquired from the western slope of the Rocky Mountains to the NCWCD on the eastern side of the mountains. In turn, NCWCD delivers water to agricultural and urban users on the basis of ownership of shares in the NCWCD. These shares are readily tradable in an active market to any user able to demonstrate the ability and intent to put the water to "beneficial use." The NCWCD facilitates trading by maintaining a bulletin board for offers to buy and sell. Brokers also play an indirect role, although they must avoid the "beneficial use-speculation" conflict. Transaction costs are very low.

Another example, the California Water Bank operated in the latter parts of the extended drought of 1986-1991. [[9]](#footnote-10)9 The California Water Bank was a State of California and Bureau of Reclamation sponsored program intended to bring buyers and sellers together during the severe drought. Transfers were for one year only, 1991, and, during this period, approximately 800,000 acre-feet changed hands.

In the western United States, one finds some significant barriers to the reallocation of water in general and to water markets in particular. First, although various parties proposed interstate water market arrangements, there are no interstate water sales. [[10]](#footnote-11)10 Many vested interests oppose **[\*360]** interstate water markets for fear of permanently losing water allocated to the state by compact. Water districts that receive water from federal and state projects generally restrict water sales and leases to district boundaries on the ground of protecting the financial base for repayment of project costs. [[11]](#footnote-12)11 Arizona allows the sale of groundwater only with the sale of the overlying land. [[12]](#footnote-13)12 California water market transactions are complicated by water laws that combine the appropriation doctrine, the riparian doctrine, old Spanish law, [[13]](#footnote-14)13 and the large amounts of state and federal project water that are distributed under contract.

Several studies focused on the economic costs of the inability to reallocate existing water supplies on an intrastate basis. H. J. Vaux and Richard Howitt estimated for California that an annual savings of $ 200 million could be achieved through interregional (North-South) reallocation of water from agriculture to urban areas, and that these savings could rise to nearly $ 3 billion by 2020. [[14]](#footnote-15)14 Richard Wahl described numerous opportunities within California and elsewhere for highly beneficial reallocation. [[15]](#footnote-16)15

On an interstate basis, J. F. Booker and R.A. Young found in their study of the allocation of ***Colorado*** ***River*** water between Upper and Lower Basins that the institutional inability to account for values created by non-consumptive instream uses (hydro-power, recreation, and salinity dilution) resulted in excessive Upper Basin consumption from an economic efficiency point of view. [[16]](#footnote-17)16 Others have estimated that instream values lost on the ***Colorado*** ***River*** due to Upper Basin consumptive uses ranged from $ 99 per acre-foot for the Green ***River*** sub-basin of the Upper ***Colorado*** ***River*** Basin to $ 341 per acre-foot for the Upper Main Stem sub-basin. [[17]](#footnote-18)17

These impediments to water transfers are due in part to the slowness of institutions to change in response to economic and social value changes. Laws, regulations, and administrative policies often lag behind the **[\*361]** changing economic, demographic, and technological scene, resulting in patterns of water use that become increasingly inefficient. Large intrastate and interstate water use inefficiencies present unique opportunities for "win-win" resolutions, *i.e.*, situations in which water transfers could produce sufficient benefits from which all affected parties could profit (in economic jargon, a so-called "Pareto improvement"). Unfortunately, it is frequently not practicable to compensate the losers from water transfers due to difficulties in identification and their potential existence in different legal jurisdictions. [[18]](#footnote-19)18 The real and perceived existence of significant uncompensated losses in areas-of-origin has stimulated resistance to large (and especially out-of-basin) water transfers generally, and to the water market process in particular.

**II. PUBLIC VALUES THAT ARE INADEQUATELY PROTECTED UNDER CURRENT WATER MARKET PROCEDURES**

Public values are values that are unlikely to be taken into account by private transactors in the market process. In the water resources area, these values include the unique importance of social and cultural values generated by water, the important instream values that are not protected by property rights, external costs imposed directly on other parties due to jurisdictional boundaries that relieve water users of liability for damage, and the "secondary economic impacts" imposed on areas-of-origin, especially agricultural communities when agricultural water use is substantially reduced. The importance of these values, in the case of water transfers, implies that market-based transactions in water are likely to generate inefficiencies and inequities to a greater extent than market-based transactions in other sectors of the economy. Ignoring or under-weighting these values can occur for various reasons as discussed in detail below.

Due largely to these highly visible, negative impacts on public values, there has been increasing resistance to water marketing and, in particular, to out-of-basin transfers of water. Recent newspaper citizen letters have expressed concerns. [[19]](#footnote-20)19 In ***Colorado***, legislation has been introduced in several recent legislative sessions to prohibit or constrain out-of-basin transfers. [[20]](#footnote-21)20 It is worthwhile, therefore, to identify these public values, to determine the extent to which they warrant protection, and to explore ways in which this protection might be provided without foregoing the advantages of water markets.

A. SOCIAL AND CULTURAL VALUES GENERATED BY WATER.

Many community values cannot be captured in monetary terms but warrant consideration in decisions about water transfers. A recent study **[\*362]** points out that water is one of the most attractive visual elements of the landscape and that in arid landscapes, especially, there is a wide range of cultural, spiritual, and religious values related to water. Current policies for water management address only a few of the relevant human values. [[21]](#footnote-22)21 This is particularly true in traditional, low-income communities in which water often plays an important symbolic, cultural role. In the Southwestern United States, the acequia system not only supports local agricultural needs, but also maintains social cohesion because maintenance of the canals and distribution of the water are community efforts. [[22]](#footnote-23)22 Costilla County, ***Colorado***, provides a good demonstration of the acequia community's cohesion: the village of San Luis, ***Colorado*** has banded together to fight the degradation of its waters caused by logging on the adjacent Taylor Ranch. [[23]](#footnote-24)23

In these old systems, the water rights typically belong to the community, so that community-wide decisions have to be made if water is to be sold and transferred outside the community. While this appears to require a consensus on water sales, the low-income levels and the seemingly high prices offered for water make such decisions difficult, requiring a tradeoff not only between the level of agricultural activities and alternatives made possible by the proceeds from water sales but between lifestyles and cultures. In a well-known New Mexico water rights case, the judge is said to have stated: "It is simply assumed by the applicants that greater economic benefits are more desirable than the preservation of cultural identity. This is clearly not so . . . I am persuaded that to transfer water rights, devoted for more than a century to agricultural purposes, in order to construct a playground for those who can pay is a poor trade indeed." [[24]](#footnote-25)24 Although this decision was reversed on appeal, it stands as a classic statement of the importance of historic patterns of water use. [[25]](#footnote-26)25 In another New Mexico case, the state engineer negotiated a compromise between the acequia and industry that sought to purchase and transfer 45.35 acre-feet of surface rights from one of the acequia landowners on the historic Anton Chico Land Grant. [[26]](#footnote-27)26 The judge stated that "the thirty to forty-five acres of land that would have gone fallow might not seem significant to the outside observer, but within the acequia system, custom and tradition require that all water users participate in the upkeep and maintenance of the entire system." [[27]](#footnote-28)27

Cultural values associated with water are not confined to particular **[\*363]** ethnic groups. Farm families place a high value on the farm or ranch lifestyle. Kenneth Weber interviewed farmers engaged in agriculture in the Arkansas Valley of ***Colorado***, farmers who "stick it out" on marginally profitable farms because they value the farm lifestyle. [[28]](#footnote-29)28 Even after selling the water from their lands, many farmers retain their farm homes. Weber found that of thirty-six Crowley County, ***Colorado*** farmers who had sold their water, [[29]](#footnote-30)29 thirty-four remained in the county. This is not to argue that traditional societies should forever remain unchanged, but it is to argue that the economic "playing field" is uneven between low-income traditional societies and the more advanced sectors, and that maintenance of these cultures is of concern to society at large.

B. ENVIRONMENTAL, RECREATIONAL, AND ECOSYSTEM VALUES GENERATED BY WATER SYSTEMS: THE PROBLEM OF "PUBLIC GOODS"

Some of the undervalued services provided by water systems, like the environment and recreation, share two unique characteristics: (1) the benefits can be enjoyed by many people without diminishing the quality of the benefit for others; and (2) it is impractical to require people to pay for the benefit. An example would be an improvement in water quality that can be enjoyed by many downstream parties including recreationists, urban utilities, agricultural irrigators, and all parties who value healthy riparian ecosystems. Such a benefit or good is called a "public good" in economic jargon, not that it is necessarily publicly provided, but that it provides widespread, non-rival benefits. [[30]](#footnote-31)30 Public goods are significant because private parties tend not to provide for or be concerned about them. [[31]](#footnote-32)31 For these reasons, public good values associated with instream flows are likely to be slighted by private water rights owners and even by public agencies that cannot gain revenues from their provision.

It is clear that water transfers can affect water quality, instream values, and riparian habitat. It is axiomatic that out-of-basin transfers will have a negative effect on the basin-of-origin and a positive one on the basin-of-destination. Diminished flows in the basin-of-origin eventually affect the **[\*364]** streambed and riparian vegetation, which in turn affect wildlife dependent on certain bank and vegetation conditions. [[32]](#footnote-33)32 This is only an example of the negative effects.

A highly visible negative effect occurs when irrigated land is dried up. If revegetation is not undertaken, noxious weeds and blowing dust are likely to result. Revegetation of long-irrigated land has proven to be very difficult due to the changes in the composition of the soil. In the case of the Rocky Ford minority transfer, the water court required that part of the water not be removed from the land until revegetation had been successfully carried out.

C. PUBLIC AND PRIVATE VALUES LOST THROUGH "JURISDICTIONAL EXTERNALITIES"

In all water administration systems, there remain unrecognized "opportunity costs" of water abstraction. [[33]](#footnote-34)33 These are downstream benefits that are lost by virtue of upstream abstraction. At the intrastate level, one can again cite the Vaux and Howitt study of transfer opportunities in California as evidence of institutional barriers to water transfers; barriers that obfuscate the true opportunity costs of the water being used in different parts of the state. [[34]](#footnote-35)34 A current case in ***Colorado*** exhibiting the same shortcoming is the Eastern Slope's rapidly-growing Arapahoe County's application for the import of 60,000 acre-feet per year from the headwaters of the Gunnison ***River*** on the western slope. [[35]](#footnote-36)35 While there is "unappropriated water" in the Gunnison system, large downstream values are generated by every acre-foot of water left in the stream. As noted earlier, Howe and Ahrens have estimated that these values for the Gunnison are at least $ 140 per acre-foot. [[36]](#footnote-37)36

A prime example of losses occasioned at the interstate level due to failure to recognize downstream costs is the increase in salinity caused by the Grand Valley Irrigation Project in Western ***Colorado***. Prior to the Bureau of Reclamation's salinity control program for the Project, G.W. Skogerboe, R.L. Walker, and Leathers estimated that the Grand Valley Project was contributing ten (short) tons of salt to the ***Colorado*** ***River*** per **[\*365]** irrigated acre per year. [[37]](#footnote-38)37 This addition of salt occurs just before the ***River*** flows out of the State of ***Colorado*** and hence through Utah to the Lower Basin. Since 10,000 tons of salt added to the Upper Basin results in an increase in a Lower Basin Imperial Dam total-dissolved-solids concentration of approximately 1 mg/l, it has been estimated that each ton of salt in Upper Basin return flows results in Lower Basin damages in the range of $ 16 to $ 48 per ton. [[38]](#footnote-39)38 Thus, one acre of irrigated land in the Grand Valley has historically contributed damages between $ 160 and $ 480 to Lower Basin.

These patterns continue not from illegal activity or ill intent but from the institutional framework for water administration. The ***Colorado*** ***River*** framework is divided into Upper Basin and Lower Basin state-by-state areas, with each assigned allowable uses under existing compacts and state laws. These jurisdictions were established to solve various political and equity problems in water administration, such as a fair, reliable sharing of water. However, the lack of coincidence between political boundaries and ***river*** basins has allowed decision-makers to ignore downstream opportunity costs. The resultant downstream externalities can be called "jurisdictional externalities." As a consequence, while the resulting patterns of water use may be considered fair in an historical context, they have become increasingly inefficient from an economic point of view. The implication is that the geographical extent of the markets is not great enough to allow the markets to reflect total system opportunity costs.

D. THE PROBLEM OF "SECONDARY ECONOMIC IMPACTS" OF WATER TRANSFERS

The phrase "secondary economic impacts" of water transfers refers to changes in the levels of economic activity experienced by those who supply inputs to or process the outputs of the seller or the buyer in a water transfer. Since the majority of transfers in the Western United States are from agricultural to urban uses, the negative secondary impacts associated with the sale of irrigation water would consist of the reduced sales of agricultural inputs like seed, fertilizer, chemicals, and equipment, and reduced levels of further processing of agricultural products. [[39]](#footnote-40)39 In economic terminology, these activities are said to be either "backward linked" (suppliers) or "forward linked" (processors) to the water selling and buying activities. The positive side of the transfer provides the **[\*366]** benefits generated by new urban supplies.

The usual economic view of secondary impacts is that they are simply the way the market works to withdraw or supplement resources at the two ends of a resource transfer. In the private sector, businesses are not held liable for losses imposed on forward or backward linked firms, so why pay attention to these effects when evaluating resource transfers that are under public sector jurisdiction? Furthermore, the secondary economic gains at the buying end presumably more than offset the secondary losses at the sale end. Thus, the usual practice in cost-benefit analysis is to omit consideration of secondary impacts. [[40]](#footnote-41)40

This attitude ignores the uniqueness of water as a social and environmental value, especially in rural areas. It also ignores the following: (1) that the secondary losses are felt in one location, while the secondary gains are generally felt elsewhere; (2) that the transfers of human and other resources away from the point of sale often take many months at the cost of job search, moving expenses, and social disturbance; and (3) that the timing of the gains and losses differ since the losses occur either prior to or during the water transfer while offsetting gains are typically in the future since cities and industry typically buy water in anticipation of future needs.

Sale of water is most frequently from marginal, depressed agricultural areas, [[41]](#footnote-42)41 often resulting in long-term unemployment of human and non-specialized resources. From the point of view of economic efficiency, the idleness of resources that would otherwise have been employed constitutes a real economic cost. Especially in the case of large water transfers, the negative secondary impacts in the area-of-origin are highly visible and attract public opposition to transfers. The absence of compensation and assistance to the area of origin exacerbates the malaise.

The analysis of data on historical transfers from the Arkansas ***River*** Valley in ***Colorado*** illustrates the negative impacts of transfers on the area of origin. The city of Pueblo, ***Colorado***, annexed land and received water transfers from nearby horticultural operations. Table 1 exhibits the estimated negative impacts of these transfers directly on agriculture and indirectly on the forward and backward linked activities of the Arkansas Valley.

**[\*367]** **Table 1**

Estimated Negative Impacts of Older Historical Transfers from Irrigation to Local Municipal and Industrial Use:

Arkansas ***River***, ***Colorado***. [[42]](#footnote-43)42

1971-1972

Direct and Indirect Reductions in Employment:

total reduction = 157 jobs

1 job per 73 acres (29 ha.)

Direct and Indirect Reductions in Regional Net Income:

$ 5,290,000 per year (1988 dollars)

$ 229 per acre-foot of consumptive use. [[43]](#footnote-44)43

These transfers, however, supported the growth of new industry in the same economic area, probably leading to net gains for the regional economy. Later transfers were larger and came from more marginal lands that had grown mostly feed and forage crops. However, these later sales were to points outside the Arkansas ***River*** Valley economic area. [[44]](#footnote-45)44 While the reductions in regional employment and income per acre were lower than for the earlier transfers, the later transfers had noticeably larger aggregate impacts. See data in Table 2.

**[\*368]** **Table 2**

Estimated Negative Impacts of 1984-1991 Arkansas ***River*** Transfers from Irrigation to Out-of-Basin Municipal and Industrial Use:

Arkansas ***River***, ***Colorado*** [[45]](#footnote-46)45

Reductions in Employment:

total reduction = 59 jobs

1 job per 1142 acres

Reduction in Regional Net Income

$ 6,740,200 per year

$ 50 per acre-foot of consumptive use [[46]](#footnote-47)46

In Crowley County, ***Colorado***, the sale of over 100,000 acre-feet of water from 40,000 acres of land under the ***Colorado*** Canal resulted in large-scale, negative impacts, including a drop in the County's tax base at a time when increased social services were badly needed. [[47]](#footnote-48)47 If further large water sales take place, it seems likely that some of the superior acreages growing the high value crops will be lost, and that impacts will be more severe.

**III. HOW SHOULD PUBLIC VALUES BE PROTECTED?**

Once it is observed that there are important public values that are unique to water resources that are not adequately protected in water market transactions, the issue arises as to how to protect the values in an economically efficient manner, *i.e.* at the least cost to the rest of the economy. Water markets will, and should, continue to play a major role in the allocation of water. However, the functioning of markets needs to be strengthened through institutional reform and constrained where it fails to account for important social values. Western United States water policy analyses suggest that the following steps warrant serious consideration.

**[\*369]** A. PROTECTING SOCIAL, CULTURAL, AND ENVIRONMENTAL VALUES

Great complexities are involved in protecting cultural values of low-income, culturally differentiated communities (*i.e.* old Hispanic communities of the Southwest) within the broader market framework of the rest of the economy. While ruling out transfers from such communities would protect one set of values, it would deny the members of the community opportunities to profit through water sales. The main protective step in such situations is to vest the water rights in the community and not in individuals, necessitating community-wide decisions to sell water. The community-wide tradeoffs between funds raised through water sales and the continuation of traditional activities can then be addressed fully.

The protection of environmental and aesthetic values requires collective action. Since individual water users will not be able in most cases to acquire sufficient water rights to protect instream flows or to offset decreases in water quality, public entities (local, county, state, or special district) should be allowed to hold water rights for instream protection purposes. An example of instream flow protection is found in a recent dedication of $ 12 million worth of water rights to protect late season flows in Boulder, ***Colorado***. Under ***Colorado*** law, the ***Colorado*** Water Conservation Board ("CWCB") administers instream flows. The CWCB is charged with enforcement of the instream rights. The process can be simplified and streamlined by allowing local and county governments and special districts to hold water rights for instream protection.

Protection of the broader range of social and environmental values requires a broadening of the "no injury" concept. The States of California, Wyoming, New Mexico, and Utah require the water transfer review process to take into account a range of community values. [[48]](#footnote-49)48

B. MITIGATING "JURISDICTIONAL EXTERNALITIES" THROUGH THE GEOGRAPHICAL EXPANSION OF WATER MARKETS

Many of the external costs imposed on other water users mentioned earlier stem from the existence of political sub-divisions that differ from the ***river*** basins being administered. Since water law in the United States is mostly a state matter, and since the historical creation of water rights could not anticipate the future values of various water uses like instream values, the rules by which water is allocated are frequently myopic from a ***river*** basin point of view. Even the interstate compacts that divide water among states become outdated from an economic point of view due to differing growth rates, economies, and demographics. [[49]](#footnote-50)49

**[\*370]** One way of mitigating jurisdictional externalities would be to establish ***river*** basin authorities or commissions with the power to consider the entire ***river*** basin in the planning process. This was, in fact, undertaken in the Water Resources Planning Act of 1965 ("1965 Act"), which authorized the establishment of ***river*** basin commissions for planning and management purposes. [[50]](#footnote-51)50 Seven commissions were subsequently established: New England, Great Lakes, Ohio, Upper Mississippi, Pacific Northwest, Souris-Red-Rainy, and the Missouri. A member from each riparian state, the Corps of Engineers, and the Bureau of Reclamation (in the West) comprised each commission. [[51]](#footnote-52)51 While some of the commissions were able to coordinate water policies, including water quality programs, others were largely ineffective due to a unanimity requirement for all decisions. The commissions established under the 1965 Act were dissolved during the Reagan administration. Other types of ***river*** basin commissions have been established under congressional approval that have been effective in dealing with basin-wide problems. The Potomac and Delaware Commissions stand out in this regard. [[52]](#footnote-53)52

Another step toward overcoming jurisdictional externalities would be to extend water markets to encompass larger parts of or entire ***river*** basins. At the intrastate level, better informational systems for offers to buy and sell water rights could be organized, similar to the simple bulletin board approach of the Northern ***Colorado*** Water Conservancy District. [[53]](#footnote-54)53 The information could be computerized on a basin-wide scale. At the interstate level, there are significant opportunities for efficient reallocations. In 1991, the State of California proposed the establishment of an "interstate water bank" on the ***Colorado*** ***River*** for organizing annual interstate water leases. [[54]](#footnote-55)54 The trades were to have taken place through each states' water agencies so that broader public interest issues would be taken into account. While the proposal was quickly vetoed by several states, interest in interstate water markets has continued. The Bureau of Reclamation has assisted the three Lower Basin states (Arizona, California, and Nevada) in arriving at an exchange and storage agreement that has many of the features of a market. [[55]](#footnote-56)55

The effectiveness of extending the geographical scope of water markets depends in part on broadening the concept of "beneficial use" and the broadening of the "no injury" requirement. Since many of the values that are currently ignored in water allocation and reallocation are instream **[\*371]** values, extending a water market to encompass downstream areas where many instream values are generated would accomplish little in a system where instream values are not uniformly recognized as "beneficial" and to which the "no injury" requirement is not extended.

C. MITIGATING THE REAL COSTS OF ADJUSTMENT FOR BASINS-OF-ORIGIN

Real economic efficiency costs are caused by the secondary impacts imposed on largely agricultural areas from which large quantities of water are transferred. These costs are imposed during the transition period on activities that are "backward linked" (supplying inputs) or "forward linked" (processing outputs) to agriculture and related populations. Communities absorb these costs, often with great hardship. Since these costs are not likely to be taken into account by buyers and sellers in water markets, excessive transfers will occur.

It would be appropriate, therefore, from both efficiency and equity viewpoints that buyers and/or sellers make compensatory payments to public authorities in the area-of-origin. [[56]](#footnote-57)56 This compensation should be in a form that will meet the priority adjustment needs of the area-of-origin. An example of *inefficient* compensation to areas-of-origin is found in the ***Colorado*** Water Conservancy District Act of 1937, which requires projects exporting water from the ***Colorado*** ***River*** Basin to another part of ***Colorado*** to provide "compensatory storage" within the ***Colorado*** Basin. [[57]](#footnote-58)57 For example, the compensatory storage provided by the ***Colorado***-Big Thompson Project took the form of Green Mountain Reservoir on the Blue ***River*** below the Lake Dillon site that was built far ahead of any need for flow augmentation.

The suddenness of some transfers leaves little time for adjustment in the exporting region and increases the severity of the impacts. Thus, a second method for mitigating the negative effects on the area-of-origin would be to require a spreading of the withdrawals over a period of years. This is frequently required by ***Colorado*** water courts for purposes of revegetating lands dried up by water transfers. Spreading the transfer over time can probably be done with little damage to the buyer of the water because cities typically buy in advance of actual need.

The negative impacts of large water transfers on areas-of-origin could be further mitigated by encouraging the lands from which senior water is to be transferred to acquire other, more junior water to keep the land in production. In water transfer cases involving ditch company shares, ***Colorado*** water courts can require lands from which the water has been sold to remain dried up in perpetuity to protect against the possibility that the ditch company might "expand its rights" by calling for water in excess **[\*372]** of the remaining historical share. [[58]](#footnote-59)58 In the case of direct transfer of state water rights, it makes sense to let the farmer sell senior rights, and then buy junior rights to maintain some form of farming operations. Depending on the reliability of the rights purchased, the cropping pattern might have to be changed but may still be profitable given the lower investment in water rights. The secondary effects on the community will be less severe than with the permanent drying up of the land. Since the purpose of water administration is "to maximize the beneficial use of all of the waters of this state," such re-watering of the land should be facilitated. [[59]](#footnote-60)59

**IV. CONCLUSION**

An evaluation of alternative water allocation mechanisms has shown that water markets play an important role, and will play an increasing role, in the allocation and reallocation of water. While markets perform the allocative role quite well within the framework of the private values of the buyer and seller, important public values are likely to be overlooked in the process. Thus, the water market process needs public attention. The positive features of water markets can be expanded in use and the weaknesses can be mitigated to maximize the social utility of these valuable social mechanisms.

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2. 2 PAUL MILGROM & JOHN ROBERTS, ECONOMICS, ORGANIZATION AND MANAGEMENT 22, 22-25 (1992). [↑](#footnote-ref-3)
3. 3 *See* RICHARD O. ZERBE, JR. & DWIGHT D DIVELY, BENEFIT-COST ANALYSIS IN THEORY AND PRACTICE (1994); Matthew D. Adler & Eric A. Posner, *Rethinking Cost-Benefit Analysis* (last modified April 1999) <[*http://papers.ssrn.com/paper.taf?abstract\_id=164902>*](http://papers.ssrn.com/paper.taf?abstract_id=164902>). Some advocate a multiple-criteria approach in which impacts on more esoteric non-market services (e.g. biodiversity) are simply described as information for the decision-making process.*See* INTERNATIONAL HYDROLOGICAL PROGRAMME OF UNESCO, MULTICRITERIA DECISION ANALYSIS IN WATER RESOURCES MANAGEMENT, U.N. Doc. SC.94/WS.14 (Janos J. Bogardi & Hans-Peter Nachtnebel eds., 1994); *see also* U.S. WATER RESOURCES COUNCIL, ECONOMIC AND ENVIRONMENTAL PRINCIPLES AND GUIDELINES FOR WATER AND RELATED LAND RESOURCES IMPLEMENTATION STUDIES (1983). [↑](#footnote-ref-4)
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6. 6 Charles W. Howe et al., *Innovative Approaches to Water Allocation: The Potential for Water Markets*, 22 WATER RESOURCES RESEARCH 439 (1986). [↑](#footnote-ref-7)
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13. 13 *See* Brian E. Gray, *A Primer on California Water Transfer Law*, 31 ARIZ. L. REV. 745, 745-82 (1989). [↑](#footnote-ref-14)
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28. 28 *See* Kenneth R. Weber, Comment, *Effects of Water Transfers on Rural Areas: A Response to Shupe, Weatherford, and Checchio*, 30 NAT. RESOURCES J. 13-15 (1990); *see also* Kenneth R. Weber, What Becomes of Farmers Who Sell Their Irrigation Water?: The Case of Water Sales in Crowley County, ***Colorado*** (Nov. 16, 1989) (unpublished manuscript, University of ***Colorado*** (Boulder) on file with author); Kenneth R. Weber, Irrigation Water Sales in Crowley and Otero Counties, ***Colorado***: Social and Historical Context (Sept. 2, 1988) (unpublished manuscript, University of ***Colorado*** (Boulder) on file with author). [↑](#footnote-ref-29)
29. 29 *See* Kenneth R. Weber, What Becomes of Farmers Who Sell Their Irrigation Water?: The Case of Water Sales in Crowley County, ***Colorado*** (Nov. 16, 1989) (unpublished manuscript, University of ***Colorado*** (Boulder) on file with author) (finding that many shares in the ***Colorado*** Canal were sold to Aurora and ***Colorado*** Springs, however, thirty-four shares remained in Crowley County). [↑](#footnote-ref-30)
30. 30 *See* CHARLES D. KOLSTAD, ENVIRONMENTAL ECONOMICS 94-95 (2000). [↑](#footnote-ref-31)
31. 31 The economically efficient price for a true "public good" is zero because it is desirable that anyone who can benefit from it should do so, even if their valuation of the good is quite low. [↑](#footnote-ref-32)
32. 32 WARREN VIESSMAN, JR. & CLAIRE WELTY, WATER MANAGEMENT: TECHNOLOGY AND INSTITUTIONS 164-83 (1985). [↑](#footnote-ref-33)
33. 33 The expression "opportunity cost" refers to the benefits relinquished elsewhere when resources are consumed by some application. It is thus the true measure of cost, as opposed to monetary costs, that frequently fail to reflect the real sacrifices made through resource use. Opportunity costs ("real costs") may be difficult to determine. [↑](#footnote-ref-34)
34. 34 H.J. Vaux, Jr. & Richard E. Howitt, *Managing Water Scarcity: An Evaluation of Interregional Transfers*, 20 WATER RESOURCES RESEARCH 785 (1984). [↑](#footnote-ref-35)
35. 35 *See* Katrina M. Ohman, Federal Public Land Agencies and Watershed Protection: The Upper Gunnison Basin (1998) (unpublished M.A. thesis, University of ***Colorado*** (Boulder)) (on file with the Political Science Department at the University of ***Colorado*** (Boulder)). [↑](#footnote-ref-36)
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37. 37 G.W. Skogerboe & W.R. Walker, *Salt Pickup from Irrigated Lands in the Grand Valley of* ***Colorado***, 2 J. ENVTL. QUALITY 377, 377-82 (1973); R.L. Leathers, The Economics of Managing Saline Irrigation Return Flows in the Upper ***Colorado*** ***River*** Basin: Case Study of Grand Valley, ***Colorado*** (1975) (unpublished Ph.D. dissertation, ***Colorado*** State University) (on file with the ***Colorado*** State University Library). [↑](#footnote-ref-38)
38. 38 Jay C. Anderson & Alan P. Kleinman, *Salinity Management Options for the* ***Colorado******River****, in* WATER RESOURCES PLANNING SERIES REPORT P-78-003, 33-37 (Utah Water Research Laboratory, June 1978). [↑](#footnote-ref-39)
39. 39 *See* Ari M. Michelsen, *Administrative, Institutional, and Structural Characteristics of an Active Water Market*, 30 WATER RESOURCES BULLETIN 971 (1994); *see also* NATIONAL RESEARCH COUNCIL, WATER TRANSFERS IN THE WEST: EFFICIENCY, EQUITY, AND THE ENVIRONMENT (1992). [↑](#footnote-ref-40)
40. 40 It is the loss of *net incomes* and not the total loss of sales that is the relevant measure for these secondary impacts. There are also non-monetary environmental and social losses and gains that stem from the secondary impacts. [↑](#footnote-ref-41)
41. 41 Charles W. Howe et al., *The Economic Impacts of Agriculture-to-Urban Water Transfers in the Area of Origin: A Case Study of the Arkansas* ***River*** *Valley in* ***Colorado***, AM. J. AGRIC. ECON. 1200 (1990); MacDonnell & Rice, *supra* note 7. [↑](#footnote-ref-42)
42. 42 The historical transfers analyzed were (1971) Las Animas town Ditch to Pueblo West, 10,000 acre-feet; (1971) Highline Canal to Pueblo, 2,600 acre-feet; (1972) Booth-Orchard to Pueblo, 9,000 acre-feet; (1972) Holson Ditch to Pueblo, 1488 acre-feet. Total acre-feet = 23,088. Total acres = 11,500. [↑](#footnote-ref-43)
43. 43 Charles W. Howe et al., *The Economic Impacts of Agriculture-to-Urban Water Transfers in the Area of Origin: A Case Study of the Arkansas* ***River*** *Valley in* ***Colorado***, AM. J. AGRIC. ECON. 120 (1990); *see also* author's background working papers. [↑](#footnote-ref-44)
44. 44 ***Colorado*** Springs and Aurora were important purchasers. While ***Colorado*** Springs is technically in the Arkansas ***River*** drainage, its economy is widely separated from that of the Valley. [↑](#footnote-ref-45)
45. 45 The transfers included were: (1984) Las Animas Consolidated Extension to Public Service Company, 10,186 acre-feet, (1985) ***Colorado*** Canal to ***Colorado*** Springs, 43,180 acre-feet, the 1974 sale of Twin Lakes shares to Pueblo, ***Colorado*** Springs and Aurora, 57,000 acre-feet, (1990) Rocky Ford to Aurora, 18,770 acre-feet, (1986) Highline Canal to Aurora, 2,250 acre-feet, and the (1991) Keesee Ditch, 3,500 acre-feet. Total acre-feet = 134,886. Total acres = 67,400. [↑](#footnote-ref-46)
46. 46 Howe et al., *supra* note 42. [↑](#footnote-ref-47)
47. 47 Kenneth R. Weber, Irrigation Water Sales in Crowley and Otero Counties, ***Colorado***: Social and Historical Context (Sept. 2, 1988) (unpublished manuscript, University of ***Colorado*** (Boulder) on file with author). [↑](#footnote-ref-48)
48. 48 MacDonnell, supra note 7; *see also* Brian E. Gray, *A Primer on California Water Transfer Law*, 31 ARIZ. L. REV. 745 (1989); Mark Squillace, *Water Marketing in Wyoming*, 31 ARIZ. L. REV. 865 (1989); Charles T. DuMars & Michele Minnis, *New Mexico Water Law: Determining Public Welfare Values in Water Rights Allocation*, 31 ARIZ. L. REV. 817 (1989); Ray Jay Davis, *Utah Water Rights Transfer Law*, 31 ARIZ. L. REV. 841 (1989). [↑](#footnote-ref-49)
49. 49 Lynne L. Bennett et al., *The Interstate* ***River*** *Compact as a Water Allocation Mechanism: Efficiency Aspects*, AM. J. AGRIC. ECON. (forthcoming November, 2000) (manuscript on file with author). [↑](#footnote-ref-50)
50. 50 Water Resources Planning Act of 1965, Pub. L. No. 89-80, ***79 Stat. 244*** (codified in scattered sections of 42 U.S.C.). [↑](#footnote-ref-51)
51. 51 *See* NATIONAL WATER COMM'N, A SUMMARY-DIGEST OF STATE WATER LAWS (Richard L. Dewsnut et. al. eds., 1973). [↑](#footnote-ref-52)
52. 52 *See* U.S. COUNCIL OF ENVTL. QUALITY, THE DELAWARE ***RIVER*** BASIN: AN ENVIRONMENTAL ASSESSMENT OF THREE CENTURIES OF CHANGE (1975). [↑](#footnote-ref-53)
53. 53 Charles W. Howe et al., *Innovative Approaches to Water Allocation: The Potential for Water Markets*, 22 WATER RESOURCES RESEARCH 439, 443 (1986). [↑](#footnote-ref-54)
54. 54 STATE OF CALIFORNIA, *supra* note 10. [↑](#footnote-ref-55)
55. 55 Robert Macy, *Three States Bank on Water Pact to Quench Future Needs*, DENVER POST, Oct. 31, 1999, at A37; Robert Macy, *Interior Green Lights Water Banking Plan*, BOULDER DAILY CAMERA, Oct. 29, 1999, at B10. [↑](#footnote-ref-56)
56. 56 Lawrence J. MacDonnell & Charles W. Howe, *Area-of-Origin Protection in Transbasin Water Diversions: An Evaluation of Alternative Approaches*, 57 U. ***COLO.*** L. REV. 527, 536 (1986); Lawrence J. MacDonnell, *The Water Transfer Process as a Management Option for Meeting Changing Water Demands*, report to the U.S. Geological Survey, No. 14-08-0001-G1538, Nat. Resources L. Ctr., U. ***Colo.*** (April 1990). [↑](#footnote-ref-57)
57. 57 *See* H.B. 714, 31st Leg. (***Colo.*** 1937). [↑](#footnote-ref-58)
58. 58 *See e.g.* [*City of Thornton v. Bijou Irrigation* ***Co****., 926 P.2d 1 (****Colo.*** *1996)*](https://advance.lexis.com/api/document?collection=cases&id=urn:contentItem:3RX3-YVT0-003D-916Y-00000-00&context=1516831) (City of Thornton purchased Water Storage and Supply Company shares). [↑](#footnote-ref-59)
59. 59 [***COLO.*** *REV. STAT. § 37-92-102(1)(a)*](https://advance.lexis.com/api/document?collection=statutes-legislation&id=urn:contentItem:61P5-WY01-DYDC-J3FN-00000-00&context=1516831) (1999). [↑](#footnote-ref-60)