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Water Transfers in Colorado: Past, Present and Future

by Burkett Huey, 2015-16 State of the Rockies Project Fellow

Western water is currently over appropriated. Many individuals have rights to water, but there is not enough water for everyone to divert as much as they are appropriated from the region's rivers. Irrigators settled the West before other users, such as cities or recreationalists, and have the oldest and best water rights under the system of prior appropriation. The West's growing population challenges the current farming-dominated water appropriation as cities seek to buy the most senior rights from irrigators. This, in turn, leads to the term 'buy and dry,' because the practice of selling irrigation water can result in economic downturn for farmers and widespread negative, third-party effects throughout rural communities. However, water transfers don't always have to place an economic burden on agricultural communities. Some examples of rotational fallowing and water leasing mechanisms in Colorado and across the West show that water transfers can provide water for urban areas and maintain the rural, agriculture livelihood.

Introduction

Long-lasting population growth, particularly urban growth, is straining Colorado's water supply and challenging the current water appropriation. Recently, for example, the Colorado River Supply and Demand Study identified a 3.2-million acre-foot imbalance between the amount of water provided by the river and the amount needed to supply the multi-state Colorado River Basin (U.S. Bureau of Reclamation 2013). Within the state of Colorado, Colorado's Water Plan identifies that municipalities are the fastest growing water users in the state and will demand more water in the coming years for their growing populations (Colorado Water Conservation Board 2015). However, the water supply is not growing. The Statewide Water Supply Initiative 2010 (SWSI) predicts irrigated acreage is likely to decrease within Colorado, which shows that new urban water will likely come from agriculture to out-of-basin municipal water transfers (Colorado Water Conservation Board 2011). Water transfers, particularly of agricultural water to out-of-basin municipal users, have become a polarizing topic within the American West. Many agricultural users are concerned about 'buy and dry' practices, as they are known in Colorado, hypothesizing that agricultural communities face large-scale economic downturn after selling irrigation water. This report examines why water transfers exist in Colorado, and shows how poorly designed water transfers can damage specialized rural economies, while well-designed transfers can leave communities better off and provide water for municipal users.

Background

The American Southwest's aridness forced settlers to develop a unique solution to water management. Colorado and every other Southwestern state determines water use through 'prior appropriation' in which the state retains water ownership, but distributes 'rights' to water users so that individuals can use water for 'beneficial use,' a use the state sees as appropriate (Hobbs 2004). These rights generally insist water is diverted from a river to be put to 'beneficial use,' such as agriculture or municipal water supply, although newer types of beneficial uses do not require diversion. The oldest 'right' to water is fulfilled first, then subsequent users receive water after the first. Senior rights, generally irrigators, have full access to water before junior rights, which include many uses, such as municipal or non-senior agricultural water rights. Water rights are property rights, and while associated with any particular parcel of land that has been watered to beneficial use, water rights can be severed from the land base. Water is measured in acre-feet, or the amount of water that is required to fill an acre of land by one foot, which amounts to about 325,000 gallons of water. Water can be bought and sold to properties upriver, downriver, or can even be pumped from one river basin to another. There is not enough water to satisfy every need, so both society and the open market decide who will receive how much water, at which times and for which uses.

Water scarcity and variability are major issues within Colorado. SWSI shows that population growth in Colorado will lead to a municipal and industrial water supply 'gap' in every water basin in Colorado (Colorado Water Conservation Board 2011). This gap is the amount of water demand beyond the amount of water available. The gap is driven by projections of urban population and industry growth by 2050, which is shown in **Figure 1** (Colorado Water Conservation Board 2010). Unfortunately, many of Colorado's rivers are already fully appropriated, meaning that all of the available water in a particular river is currently being used, and that some water rights holders are unable to receive their appropriated right. Thus, issuing new water rights is not a solution. Further population growth will complicate our water appropriations.

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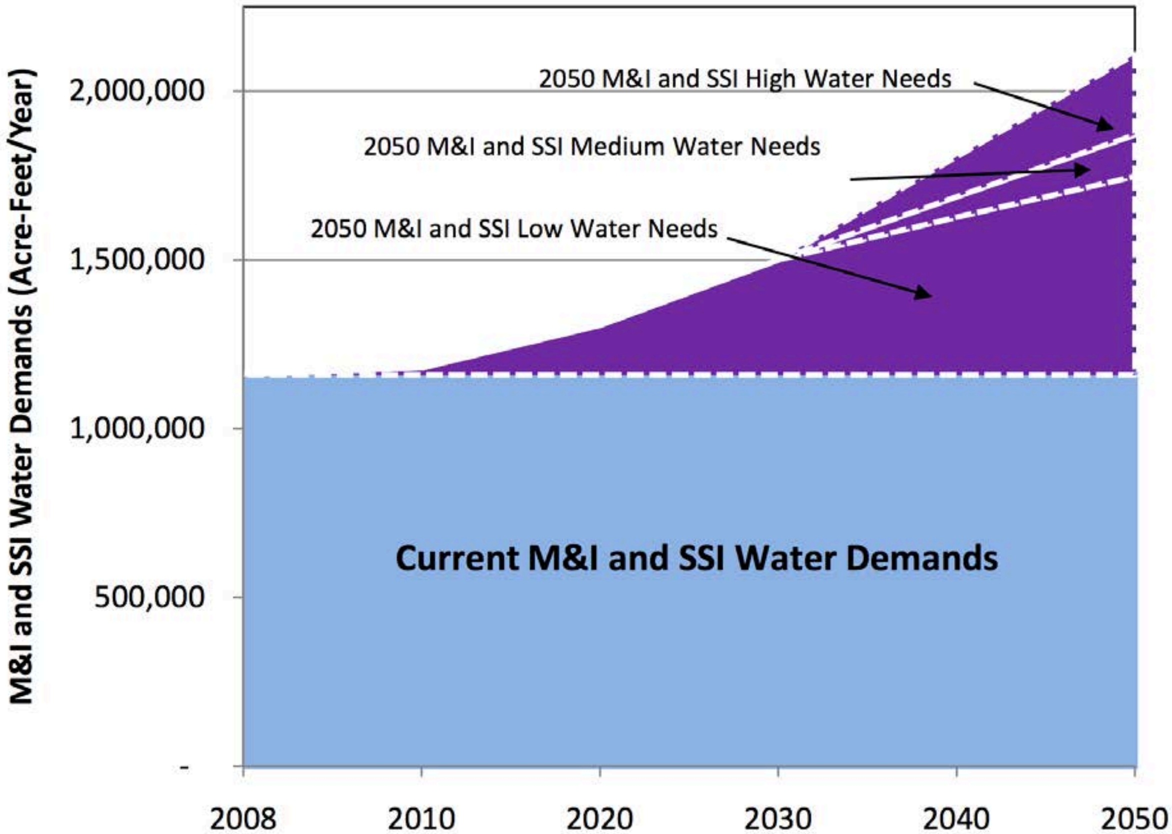
Figure 1: Existing and Future Water Supply Demands in Colorado



Source: Colorado Water Conservation Board 2010.

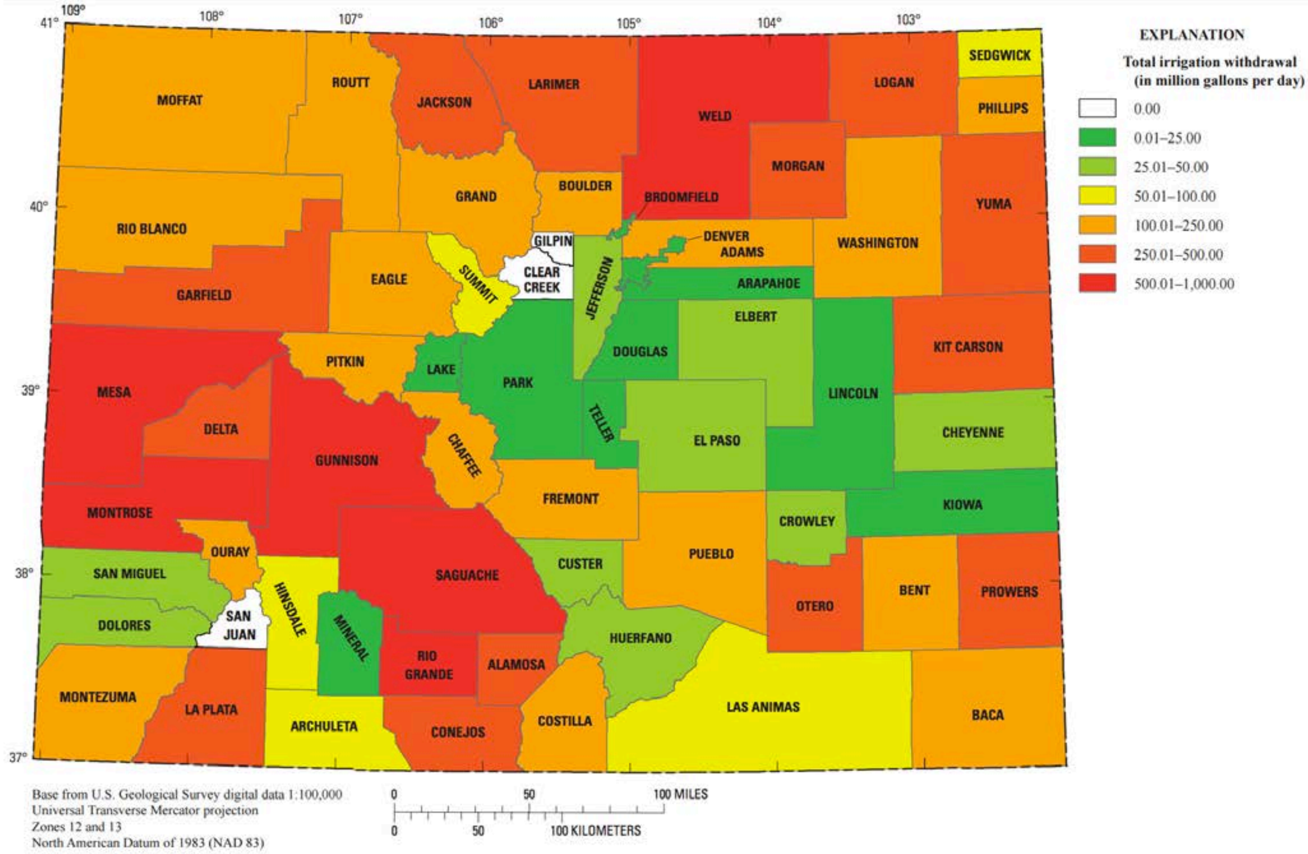
A further complication of Western water management is significant yearly water variability. The Colorado River Compact of 1922 is an excellent example using estimates to manage variability. The Colorado River Basin's population grew rapidly during the early 20th century, and the multi-state region needed to develop a way to divide the limited water resources between separate political units of an inhomogeneous region. The Compact appropriated half of the Colorado River's water, 7.5 million acre-feet, to both the Upper Basin and the Lower Basin per year during a time of relatively high water flows. Unfortunately, the Colorado River is highly variable and does not always deliver this amount of water. Thus, when considering long-run average flows, the planners over appropriated the river, generating interstate conflict (Woodhouse et al. 2006). For instance, the Colorado River has recorded a minimum of 5.6 million acre-feet (1977) and a maximum 25.2 million acre-feet (1984) at Lee's Ferry, the separating point between the Upper and Lower Basin (U.S. Bureau of Reclamation 2013). This variability is part of the key issue that strains the Colorado River as we do not know the exact amount of water that will be supplied. In response to variability, water is measured over longer terms in the Colorado River Compact: 75 million acre-feet must be delivered to the Lower Basin every 10 years. Although this still leads to an imperfect estimation that is inflexible with climate change, necessity dictates that we plan our water usage over a long-term period. To further hedge against variability, the U.S. Bureau of Reclamation (USBR) constructed Glen Canyon Dam to produce Lake Powell, which divides the Colorado River's Upper Basin and Lower Basin and allows water managers to control the flow of water in any given year. Although there are negative consequences of dams, reservoirs are effective methods for reducing variability in water supply.

Despite its faults, the Colorado River Compact has provided water for the burgeoning Southwest for the past 90 years. The recent, ongoing drought in the Southwest reminds us that uncertainty in the Colorado River Basin's water supply is part of the hydrologic system. Since many Front Range cities are dependent on variable Colorado River water and will continue to sustain population growth, well-designed water transfers will be increasingly necessary to get water from a delicate basin to thirsty cities.

Stakeholders

The major uses of Colorado's river water are agricultural, environmental, municipal and industrial, and recreational. All water users would like to have access to Colorado's rivers, but there is a limited water supply. Agricultural water users use the vast majority of Colorado's water, 90.9% of water usage (Ivahnenko and Flynn 2008, p.5). Agriculture produced about $7.7 billion in total sales in 2012 (U.S. Department of Agriculture 2012). Cattle are the most valuable livestock in Colorado, and generate $4.3 billion in sales, which is 55% of all agricultural sales from Colorado (U.S. Department of Agriculture 2012). Agriculture's major water usage comes from producing feed: each acre of alfalfa uses between 23.7 and 37.7 inches of water in Colorado, which adds up over the 500,000 acres irrigating alfalfa in Colorado (Berrada and Reich 2006; U.S. Department of Agriculture 2012). The cattle themselves do not drink an exorbitant amount of water, yet growing feed for cattle uses a large amount of water. Agricultural water

Figure 2: Relative magnitudes of irrigation water use in Colorado



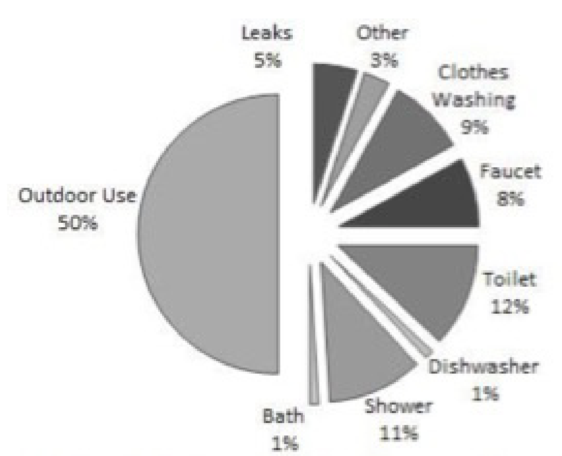
Source: Ivahnenko and Flynn 2005.

users in Colorado are widely dispersed, but as Figure 2 shows, some counties, such as Weld County and Mesa County, are heavily irrigated. Agricultural rights to use water are derived from their ability to divert river water into an irrigation ditch and then use it to irrigate land (Hobbs 2004).

Municipal users are towns and cities, which sell water to residential homes for two major purposes: indoor use and outdoor use. Indoor and outdoor water uses each represent about half of municipal water use (Hobbs 2004). Indoor use is generally split between toilets, dishwashers, sinks and clothes washers; water for drinking is negligible from a statewide water planning perspective. Outdoor use is almost exclusively lawn irrigation. Home water use is further explained in Figure 3. Municipal users are some of the fastest growing in Colorado, but only in a few rapidly growing metropolitan areas. The major municipal areas are on the Front Range and contain about 80% of the population, but receive only about 20% of the precipitation. Municipal use accounts for 7.9% of water usage in Colorado (Ivahnenko and Flynn 2005). **Figure 4** displays the total estimated uses of water in Colorado and shows that municipal areas, such as Denver County, El Paso County, and Boulder County generally use between 100 million and 250 million gallons per day.

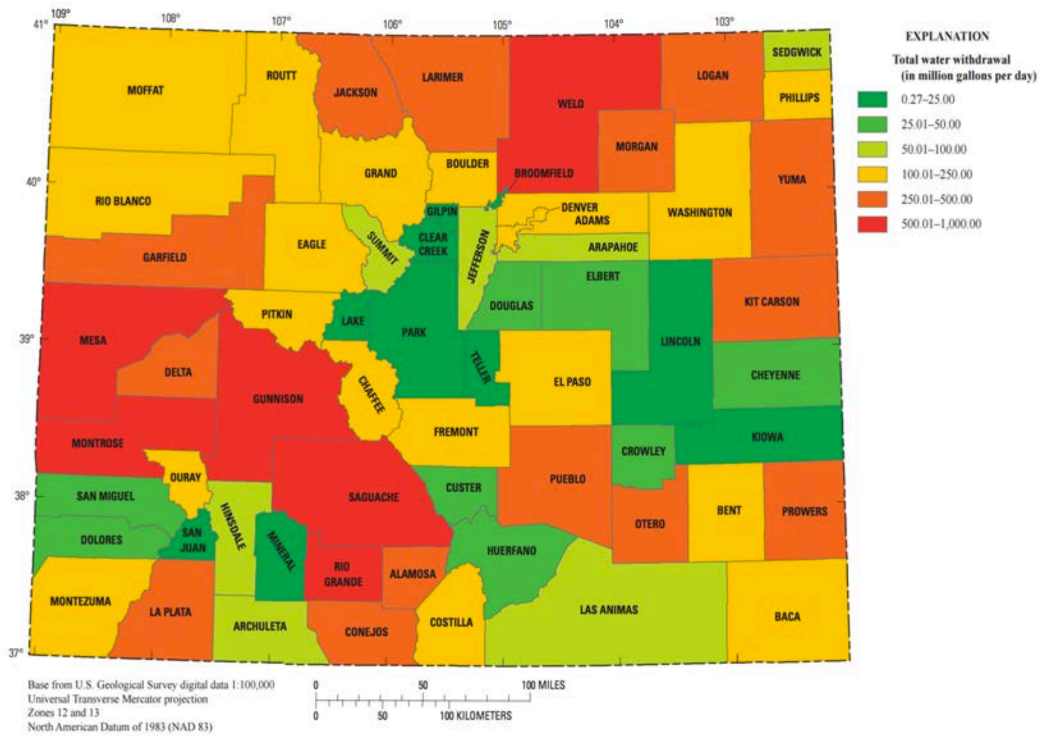
In the last forty years or so, a new set of stakeholders for water use has emerged: environmental and recreational users who want to keep water in rivers. These users are concerned with the health of the ecosystem and the quality of their recreational experience. Environmental and recreational users were the last users to receive water rights because water law did not initially recognize the environment as a beneficial use for water. All water rights required the user to divert water from the natural course of a river (Merriman and Janicki 2005). This changed in 1973 when the Colorado General Assembly approved instream flow water rights, which allows the Colorado Water Conservation Board to purchase water rights and provide basic minimum protections for streams (Merriman and Janicki 2005). **Figure 5** shows a map of all the instream flow rights in Colorado, most of which are high mountain creeks. These rights are generally relatively small; many are under 10 cubic feet per second and are designed to keep a minimum water flow available for critical habitats. Recreationalwater rights were recognized even later, in 2001 (Hobbs 2015).

Figure 3: Relative proportions of water use in residential homes in Colorado



Source: Watson and Neibauer 2014.

Figure 4: Withdrawls and use of water in Colorado



The relative magnitudes of water usage in irrigation centric counties, such as Montrose and Gunnison Counties, opposed to municipal water use counties, such as Denver or El Paso shows that irrigation uses more water than Colorado's densest cities. Source: Ivahnenko and Flynn 2005.

Recreational in-channel diversions can only be owned by cities to create whitewater parks. These recreational users demonstrate beneficial use as the water users are generating income and tourism in the community while water remains in the stream.

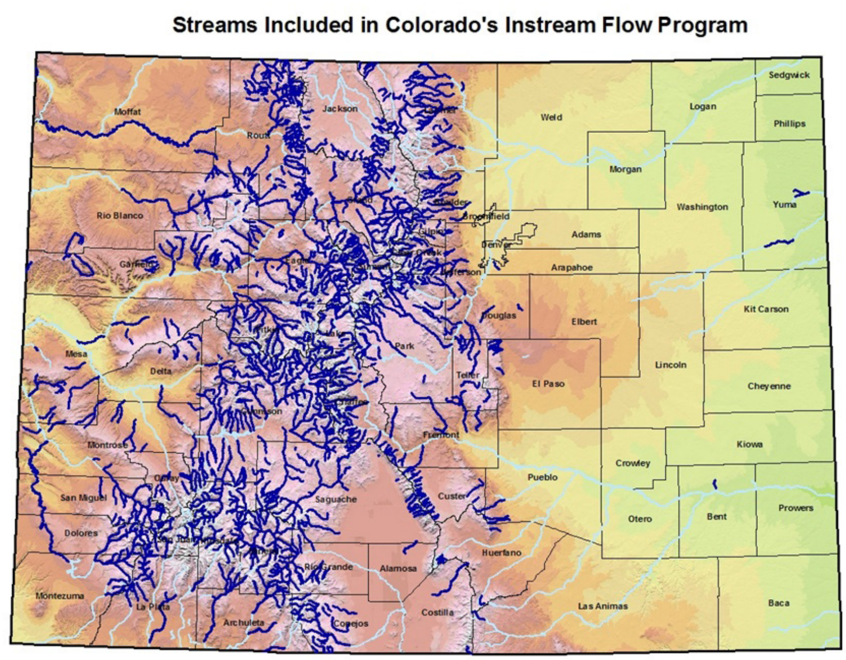
Value of Water: Real Terms

Since different water users can generate different amounts of economic activity, trade allows both parties to be wealthier. Economically, users who generate lower economic value from water could trade their water to users who generate higher economic value from water for money. Higher value water users can compensate the individuals with lower value for their lost water and still be better off. The purpose of this section is to roughly show differences in revenues generated from water.

Generally, farmers have lower water value, but different crops generate different values. A major crop in Colorado is alfalfa, which is used as feed for Colorado's large cattle population. Colorado produces about 1.8 million tons of alfalfa every year over several hundred thousand acres (U.S. Department of Agriculture 2012). Alfalfa is useful because it provides a "high protein, low fiber feed," that is relatively cheap and widely grown throughout the state (Berrada and Reich 2011; Balliette and Torrell 2012). Although different regions use different amounts of water for growing alfalfa, alfalfa's average consumptive use across the Great Plains and Intermountain West is 35.8 inches of water per year (Berrada and Reich 2011). For the sake of this rough calculation, this average will be rounded up to 36 inches, or three acre-feet. The United States Department of Agriculture publishes statistics on yield per acre, and alfalfa yields on average about four tons per acre (U.S. Department of Agriculture 2016). As of September 2015, a ton of 'good' alfalfa from the mountains of Colorado will produce $140, or 'supreme' alfalfa will produce $210 (U.S. Department of Agriculture 2015). Although these are very broad averages, this shows yield on an acre-foot of water to be around $180 for 'good' alfalfa or $280 for 'supreme' alfalfa.

Municipal water users can generate more gross revenue on an acre-foot of water because urban users are willing to pay more for water. In Denver, the average household uses about 115,000 gallons of water a year, which is a little over a third of an acre-foot of water (Denver Water 2015). An average bill for a city-dwelling Denver water user is $454.88, which means that Denver could make about $1,300 from an acre-foot of water.

Figure 5: Instream flows in Colorado



Source: Colorado Water Conservation Board 2011

Trade is implicitly good for both parties involved: otherwise they would not engage in a voluntary trade. Both parties receive benefits from trade: people who are willing to pay more for water receive the right to use water, and owners of water rights are compensated. Despite these mutual benefits there still are very few transactions. Robert Young (1986) hypothesizes various reasons why there are few water transfers. One reason is "barriers to interstate transfers of rights to water," which means that although rivers can flow through many states in the West, it is almost impossible for users to trade their right to water between states (Young 1986). Secondly, the "protection of valid third-party interests is too often accomplished by outright prohibition of all transfers with adverse third-party potential" (Young 1986, p.1150). Although irrigation water sales can negatively impact communities without compensation, these negative impacts are not equal across communities. Young (1986) is a supporter of agricultural to municipal water transfers, because of a general "unrealistic and inflated idea of the net economic contribution of irrigation to the economy." Because the value of farming is so low, maybe it would be better for society to allow everyone to easily sell their water if they so choose (Young 1986). If the public, however, sees an enduring value in irrigation and the value it brings to an economy, another potential part of a solution is to provide information on the third-party impacts of potential water sellers. This can be used to learn how dependent the economy is on agricultural production in the area. I will discuss this more in the next section.

Denver Water is clearly generating more revenue than an alfalfa-producing irrigator. This is the reason why many of the water transfers in Colorado are from agricultural users to municipal users. The issue, however, is more complicated than this. Much farming occurs in river basins, such as the Gunnison and Colorado, which are water rich, but are far away from urban areas that have the highest demand for water in Colorado, which are generally within the South Platte and the Arkansas River Basins. To work around this reality, engineers have developed trans-mountain diversions, which utilize pipes and pumps to transfer water from across water basins, generally from the Western Slope to the Front Range. This is because the majority of the precipitation in Colorado falls west of the continental divide, while most of the state's population live on the Front Range, as shown in **Figure 6**. Western Slope stakeholders criticize these water transfers because "when water is diverted to the eastern slope…the only consequences are negative ones from the Western Slope perspective" (Howe & MacDonnell 1985). Although trans-mountain diversions are now a necessary aspect of water management in Colorado, they are controversial because of the negative indirect impacts to communities. The next sections of this report will focus on trading and examines water transfers to find mechanisms that minimize negative indirect effects.

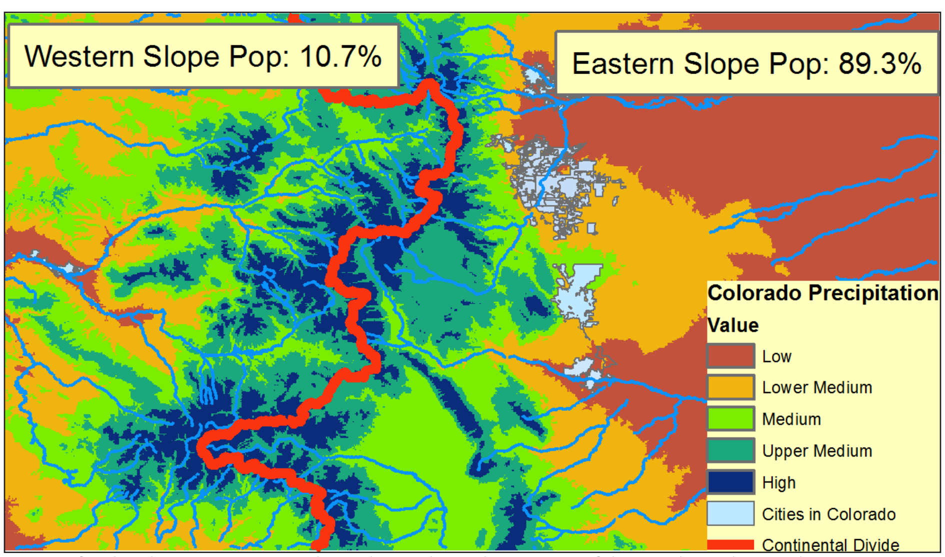
Trans-mountain Diversions and Third-Party Impacts

The fundamental imbalance of water falling on the Western Slope and the individuals who are most willing to pay for water living on the Front Range necessitates trans-mountain diversions. These diversions are politically contentious, as shown by the Colorado Water Plan's examination of motivations: "Generally Eastern Slope [roundtables] identify the need...to preserve future development of the Colorado River System" while "Western Slope roundtables express concern regarding the impact on future development on the Western Slope." These diversions are extremely useful in Colorado's water planning because they provide water to individuals who need water. However, there are serious concerns about the negative impacts to the basin of origin. This section seeks to examine the effects of previous trans-mountain diversions economically and environmentally.

Water transfers, particularly the trans-basin water transfers, are a controversial issue in Colorado because of third-party effects. Negative economic impacts occur in a broader agricultural community because a decline in the agricultural sector from a loss in irrigation water can lead to a broader economic downturn. Farming requires machinery and labor. These costs support businesses and individuals in the area, such as a tractor supply store or laborers, and keep the rural economy running. If a farmer spends a dollar on gasoline, that dollar could go to a worker at that store, who could then purchase food at a grocery store, which could then purchase vegetables from the farmer. In this way, dollars can stay in a local economy for several purchases and benefit multiple people in a society. If this cycle stops with irrigated agriculture, then all of these industries are negatively impacted, not only farms.

When farmers sell their water outright, they receive a single payment and sell their long-term right to their water. This has been done on the Western Slope on a small scale, but has been done on a large scale on the Eastern Slope. This is popularly known as "buy and dry," which accuses cities of purchasing water rights from irrigated farmland, and then removing all agricultural potential from a dry area. MacDonnell and Rice (1993) recognize the Lower Arkansas Valley's "loss of sugar beet processing facilities in the 1960s and 1970s… noticeably weakened the agricultural economy in the area" (p.3). The Arkansas Valley water transfers

Figure 6: Precipitation and Population Centers in Colorado



A map of Colorado's precipitation and population shows the majority of the population live on the Eastern Slope, but the majority of precipitation falls on the Western Slope. Source: Burkett Huey, using formatted USGS National Hydrography.

occurred because farmers were not able to sell their sugar beets and used the payment from water transfers to pay down farm debt. In the long run, however, the transfer exacerbated the effects of economic depression and shocked the local economy because farmers did not have a constant stream of income without irrigation. Due to economic isolation and a "specialized, marginal" economy, the farmers in the Lower Arkansas Valley did not have opportunities for other jobs and could not easily move to other industries (Howe and Goemans 2003). There were no other industries in the Lower Arkansas Valley after sugar beet farming became uneconomical, so the impacts of a loss of irrigation water had larger impacts on employment and related industry employment. It is important to note that these effects are not singular. In the more prosperous South Platte region, in which irrigators had other employment options, water transfers did not have as severe of an effect on the local economy and, in fact, may have benefitted the region by shifting production from less productive uses to more productive uses (Howe and Goemans 2003; Thorvaldson and Pritchett 2006).

These effects are generalized, and would be much more useful if there were ways to quantify the effects of water transfers in units that are easy to understand. Several modelers use input-output analysis for measuring the dollar value of the direct losses to a farmer, and indirectly to the related industries (supply stores, etc.). Howe and Goemans (2003) compare the negative impacts from these water transfers in simple dollar values per acre-foot of water lost and then per capita, as seen in **Figure 7**.

In a specialized agricultural area, such as Crowley County in the Arkansas Valley, water transfers can severely damage a local economy (Taylor and Young 1993). In **Figure 7**, the difference between the direct impacts and direct plus indirect impacts shows the third-party effects of water transfers. If an area is reliant on irrigation water for farming, and has few other opportunities for business, Howe and Goemans (2003) suggest "extra market assistance to basins of origin ….The set of criteria to be considered by the transfer agencies in approving, modifying, or disapproving water transfers should be expanded to include consideration of the secondary economic and social costs imposed on the basin of origin," because the uncompensated losses of particular rural communities can be devastating. These strong negative impacts in the Arkansas Valley, and particularly in Crowley County, show the importance of creating a sustainable water transfer mechanism, one that allows municipalities access to water and positively impacts rural society.

In addition to negative economic effects of water transfers, there are negative environmental third-party effects of trans-mountain diversions. One example is the 15-Mile Reach in Colorado—the 15 miles of the Colorado River east of Palisade to the confluence of the Gunnison River and the Colorado River. This area is critical habitat for the four endangered fish in Colorado: the Colorado Pikeminnow, Razorback Sucker, Humpback Chub and the Bonytail Chub. A major concern of USGS and USBR is keeping endangered species alive through maintaining suitable river flows. Flows have dropped below these minimum flows during drought conditions, because of the Colorado River's trans-mountain appropriation and the heavy irrigation, which has been a challenge. Cooperative management may be a potential solution to these environmental problems. In the case of the 15-Mile Reach, several stakeholders worked together to provide endangered fish critical habitat. The USBR used a timed water release from Ruedi Reservoir for higher flows (Bassi and Kowalski 2015). Several irrigators reduced their water consumption in return for financial assistance with water projects. Cooperative management has been essential to maintaining the 15-Mile Reach as quality habitat for fish. The challenge to keep endangered species alive under population growth scenarios, which demand trans-mountain diversions and intensive irrigation, will continue to strain the species dependent on adequate flows in the 15-Mile Reach and other critical environmental habitats, but we have advanced methods of regulating rivers to benefit endangered species.

Figure 7: Impacts of water transfers in the South Platte and Arkansas Basins, Colorado

TABLE 2. Direct and Indirect Negative Impacts of Selected Water Transfers on Basins of Origin: South Platte and Arkansas Basins, Colorado.

	Direct Impacts		Direct + Indirect	
	South Platte	Arkansas	South Plate	Arkansas
Output (per acre-foot)	65.08	88.99	104.06	117.02
Tax Impact (per acre-foot)			8.83	12.24
Personal Income (per acre-foot)	8.52	17.89	21.6	28.48
Employees (per 1,000 acre feet)	1.29	2.02	1.78	2.57
Output (per capita)	1.61	14.11	2.56	18.51
Tax Impact (per capita)			0.22	1.72
Personal Income (per capita)	0.21	2.63	0.53	4.27
Employees (per 100,000 people)	3.92	35.26	5.63	43.49

Figure 7 shows the direct and indirect impacts of water transfers in the Arkansas Valley and the South Platte. The indirect effects of water transfers in the Arkansas Valley are much higher than in the South Platte. Source: Howe and Goemans 2003.

Figure 7 shows the direct negative effects of a water sale. Note that only the farmer receives any payment for this water, so the indirect effects to non-water owners are not compensated for their lost potential revenue in this model. This also only shows the short run impacts, before communities have the time to "react to a reduction in agricultural output" (Howe and Goemans 2003). The farmers used the revenue from water sales to pay off longstanding farm debt, so they would be presumably better off financially, but the money came in one lump sum, which reduces personal income as shown in **Figure 7** in the long run. Importantly, this reduces the number of employees in the Arkansas River Valley by 35.26 per 100,000 people in direct farm jobs. There is a much smaller effect in the South Platte due to the robust economy and the ability for farmers to adapt more quickly.

Water Transfers that Minimize Third-Party Effects

Water transfers are an effective way of getting water to individuals who are willing and able to pay the most for water, but should be designed to minimize negative impacts. The Statewide Water Supply Initiative recognizes that Colorado's water needs are going to expand because of our growing population. Trade is good when it allows individuals without access to water in a state where virtually all the rivers are over appropriated. Trade can be good for the individuals losing the water, if they need a more liquid asset, such as cash or a stream of income. What are the ways to design a water transfer to minimize the third-party effects? What, reasonably, can be done to prevent sustained economic downturn with a transfer of irrigation water to municipal users?

One answer is that a transfer does not necessarily need to be a sale. One way of transferring water that addresses third-party impacts is to use a lease to provide irrigators with a constant stream of income, and allows continued rural ownership of water rights. Although these are more expensive to municipalities, irrigators are more comfortable transferring large quantities of water under a lease: leases account for up to 90% of water volume transferred in the West (Brewer et al. 2008). Water leasing is increasingly being used to acquire water for long-term purposes, which shows that water planners are using leases for long-term plans, rather than quickly meeting excess demand (Brewer et al. 2008). Water leasing is a relatively new method of transferring water from one user to another, but it is a useful technique for large water volume transfers.

Another method to transfer water from agriculture to municipalities that minimizes third-party effects is a rotational fallowing agreement. Rotational fallowing is a program in which some land is used for farming, while others are fallowed and the water from the fallowed farms is sent to cities. The next year, a different group of farmers in the same area will fallow their land and send an equal amount of water to a municipality. Fallowing part of an agricultural community, rather than the entire community, makes indirectly related industries more able to survive, because the reduction in demand for their goods is smaller.

Case Study: Arkansas Valley Super Ditch

One attempt to utilize a rotational fallowing agreement in Colorado is the Arkansas Valley Super Ditch. To ensure agricultural concerns about buy-and-dry practices are mitigated, the Super Ditch specifically maintains that transfers are temporary transfers, as water leases. This mitigates concerns so farmers who do not want to farm during a given year retain the ability to do so in the future. Transfer obligations can be shared, so that multiple farmers can divide a transfer amongst themselves if they so choose. McMahon and Smith (2012) examine the effects of the Super Ditch along with the proposed lease payment, and found that the lease payment ($1,510 per hectare lost) exceed the total direct and indirect net losses ($1,172 hectare out of production) on a yearly basis. The lease payments change the nature of the economy slightly because spending changes from agricultural goods to consumer goods. Additionally, in the Arkansas River Valley dryland farming is possible, which further increases the net benefits to irrigators and reduces the impact on related agricultural industries. Therefore, the irrigators and the communities surrounding irrigators are better off by trading their water because the system is "turning the farmer's water into a second cash crop" (McMahon and Smith 2012). Although the legal challenges of water transfers persist, the Arkansas Valley Super Ditch is a transfer mechanism that works for both partners.

Case Study: Palo Verde

The agricultural Palo Verde Irrigation District in Southern California has run a successful experiment with rotational fallowing. Southern California's Metropolitan Water District needed to find water in the early 2000s to serve Los Angeles's rapidly growing population. One way they worked with this issue was developing a rotational fallowing agreement, which transfers between 25,000 and 118,000 acre-feet to Los Angeles at a price of $738 per acre fallowed and adjusted for inflation (Metropolitan Water District of Southern California 2013). This program is voluntary, and makes farming generate higher yields during the non-fallowed years because the land recharges (Metropolitan Water District of Southern California 2013). Additionally, this program has popular support because farmers view it as an "opportunity for the area's economy on the grounds that it helps stabilize farm incomes," which is important because farmers can be resistant to water transfers (Hanak 2003, p.72). The Palo Verde program deliberately mitigates some of the third-party impacts from a reduction in irrigation water through limiting the size of the program to fallowing a maximum of 28% of land in the Palo Verde Irrigation District (Hanak 2003; Metropolitan Water District of Southern California 2013). The government limits the size of the rotational fallowing program so that enough irrigators farm to keep related businesses thriving. This program has been a success, as the value of agriculture in the Palo Verde Valley has increased in the past years (Riverside County Agricultural Commissioner 2014). The city of Los Angeles wins because this transfer mechanism allows the municipality access to water, and the city has a high enough value of water that it can compensate the irrigators and the community for potential economic damages.

Conclusion

Water transfers are a powerful tool to ensure the West is prepared for its imminent population growth. Since most of the American West is semi-arid, society needs to make decisions on who gets how much water, and the most efficient solution is likely not the original water appropriation. Water transfers are a necessary way to allow the highest value water users access to water, which is good for society as a whole. Water transfers can be designed to ensure that both rural communities and municipalities can end up better off through rotational fallowing agreements and water leasing. These mechanisms ensure that irrigators maintain a stream of income and a continuous flow of money into the economy. They also avoid a permanent outright loss of rural water rights. Secondly, the impacts of removing a specific amount of water can be estimated before the transfer, and can allow communities to prepare for economic change before the water transfer occurs. Additionally the effects of the lease payment can be quantified and then used as evidence for or against any particular water transfer. Thirdly, water transfers need to recognize and mitigate concerns of current water rights holders to prevent future issues in water transfers. Third-party effects of water transfers are real concerns that need to be continually addressed in most future water transfers. But, well-designed water transfers have the power to implement a positive outcome for the buyer, seller and communities. This is important because Colorado's Front Range population is going to continue to rapidly grow and needs water access, but rivers in Colorado are already over-appropriated. Water transfers that do not leave the community better off generate political resistance, which can prevent water transfers from occurring (Young, 1986). Well-designed water transfers leave the community of origin better off, which will make Colorado's growth easier.

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