

# Agricultural Water Transfers in the Western United States

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*The Robert B. Daugherty Water for Food Global Institute at the University of Nebraska is working to achieve greater food security with less pressure on scarce water resources by improving water management in agriculture. Through scientific and policy research, education and communication, the institute is helping the world's farmers produce greater yields while maintaining water supplies to meet other vital human and environmental needs.*

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## *Executive Summary*

Irrigation for agricultural production represents the largest consumptive use of water in the western United States. Understanding the ways in which agricultural producers respond to physical and institutional water scarcity is therefore key to managing water risk. One of the important risk management tools available to agricultural producers is the ability to transfer water across space and time. Water transfers range from very informal handshake agreements between neighbors to very formal transfers of real property across large distances with mandatory state and federal reporting.

Given the range of potential water transfer mechanisms, there are significant knowledge gaps on the variety, scale, and scope of agricultural water transfers. The goal of this report is to improve understanding of the state of water transfers between agricultural producers in the American West. It is intended for a broad range of practitioners including water district managers and board members, commodity groups, individual agricultural producers, policymakers, researchers, and others interested in gaining insights into how the agricultural sector currently reallocates water, and challenges and opportunities for improving water reallocation.

This report was informed by interviews with dozens of water practitioners. Common themes emerging from the interviews include:

- Water transfers between agricultural producers are widespread in the American West, implying that these transfers provide value and risk management
- Most water transfers seem to be informal and occur at a local, within-water district level
- Data collection about transfers is limited and the terminology used is localized and variable: often water transfer participants do not self-identify as undertaking water transfers
- Well-defined property rights with strong enforcement encourage water transfer activity

In addition to synthesizing key practices and results, the report provides examples of many different kinds of water transfers and supporting mechanisms that are in operation across the western United States.

*Background: Water Scarcity in the American West*

From the arid deserts of the Southwest to the rainforests of the Pacific Northwest and from the prairies of the High Plains to the forested Sierra Nevada and Rocky Mountain ranges, the Western United States is characterized by diverse landscapes, climate, and geography. Average annual precipitation exceeds 100 inches on the coast of Washington State and is less than 10 inches in much of Nevada (Figure 1<sup>1</sup>). Many of the crop-producing regions of the West have arid or semi-arid climates, including the Central Valley of California, the Yakima Valley of Washington State, and the High Plains. While such regions have good soils and temperatures for crop growth, limitations on water resource availability remain an issue. In addition to arid conditions, there are several, often compounding, causes of water scarcity in the West, including a history of over-appropriation of water rights, drought and climate change, and changing needs around water use, such as increasing water demands spanning agricultural, industrial, municipal, and environmental uses.

*There is not sufficient water to irrigate all the lands which could be irrigated.*  
John Wesley Powell

<sup>1</sup> PRISM Climate Group. 30-year normals, 2015. URL <http://www.prism.oregonstate.edu/normal/>

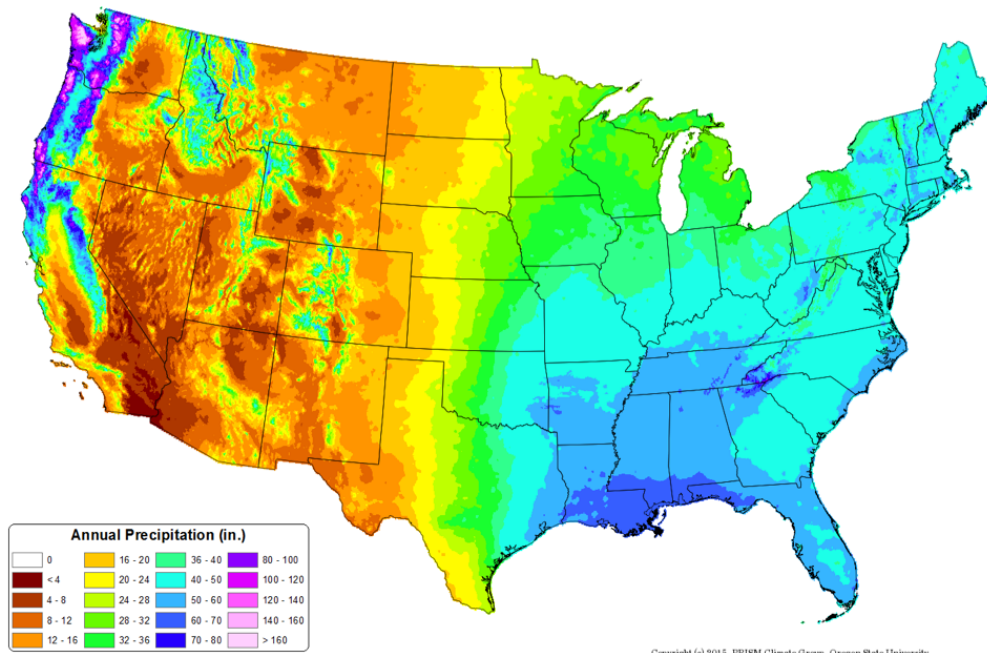


Figure 1: 30-year normal annual precipitation of the contiguous United States between 1981 and 2010.

In the western United States, there is often a mismatch in space and time between the supply of water and demands for it. Many rivers and aquifers are over-appropriated, meaning that in an average year, there is not enough water to satisfy all existing water rights claims. For example, the Colorado River Basin, which was allocated during a period of relative water abundance, is over-appropriated by an estimated 24 percent<sup>2</sup>. Over-appropriation is exacerbated by high

<sup>2</sup> United States Geological Survey. *Climatic Fluctuations, Drought, and Flow in the Colorado River Basin*. USGS Fact Sheet 2004-3062, Version 2. U.S. Department of the Interior, 2004. URL <https://pubs.usgs.gov/fs/2004/3062/>

inter-annual variability of available water, which is a fundamental feature of Western water. After enduring a six-year drought, California experienced record high levels of snowpack for Winter 2017<sup>3</sup>. Yet, in Winter 2018, much of the state was once again under abnormally dry to moderate drought conditions<sup>4</sup>. The West's susceptibility to drought and variability in temperatures, snowpack, precipitation, and runoff in streams and rivers exacerbate water security and scarcity concerns.

Finally, while water management and appropriation in the 19<sup>th</sup> and early 20<sup>th</sup> centuries primarily benefited offstream water diversions for human needs, increasing public pressure and the passage of the Federal Endangered Species Act (ESA) have led to an increasing focus on water management for instream ecosystem and habitat functions. In order to achieve the goals of the ESA, water managers in some instances have leased, retired, or subordinated some human uses of water in order to leave water instream for environmental purposes<sup>5</sup>. There have been varying degrees of success and cooperation for achieving environmental water uses, where some basins have developed model programs for jointly managing scarce water for human and environmental needs, and other basins have struggled.

### *Water Transfer and Sharing Arrangements as Solutions*

Agriculture, particularly for irrigation, is the largest consumptive use of surface water and groundwater in the United States, accounting for approximately 60 percent of freshwater withdrawals excluding thermoelectricity<sup>6</sup>. As of 2013, the value of production on nearly 40 million irrigated acres of farmland in the 17 western states exceeded \$96.8 billion<sup>7</sup>, representing a significant stakeholder in water use and scarcity.

Water scarcity in the western United States has led to multiple innovations in agricultural production: improving irrigation technology, adopting best management practices, switching to comparatively higher net revenue or less water-intensive crops, and growing participation in water sharing arrangements, or water transfers. Water transfers refer broadly to a variety of voluntary transactions that allow producers to reduce risk around water resource uncertainty and to reallocate water from relatively low to relatively high value uses, increasing the aggregate benefit of limited water resources. Such transfers include leasing, permanent sales, pooling, and other arrangements, which are described in detail in this report. Transfers explicitly or implicitly monetize water and its conservation. Appropriate incentives can improve drought resiliency and reduce

<sup>3</sup> N. Rott. California's near-record snowpack is melting into raging rivers. Morning Edition, National Public Radio, 2017. URL <https://n.pr/2tq5CtD>

<sup>4</sup> B. Fuchs. United States Drought Monitor map for January 11, 2018, 2018. URL <http://droughtmonitor.unl.edu/>. National Drought Mitigation Center, U.S. Department of Agriculture, and National Oceanic and Atmospheric Association

<sup>5</sup> L. Kreiger. California drought: Delta smelt survey finds a single fish, heightening debate over water supply, 15 April 2015. The Mercury News

<sup>6</sup> M.A. Maupin, J.F. Kenny, S.S. Hutson, J.K. Lovelace, N.L. Barber, and K.S. Linsey. *Estimated use of water in the United States in 2010*. U.S. Geological Survey Circular 1405. 2014. URL <http://dx.doi.org/10.3133/cir1405>

<sup>7</sup> G. Schaible. Understanding irrigated agriculture, 2017. URL <https://www.ers.usda.gov/amber-waves/2017/june/understanding-irrigated-agriculture/>. U.S. Department of Agriculture, Economic Research Service; and United States Department of Agriculture. *Farm and Ranch Irrigation Survey (2012)*. 2012 Census of Agriculture. U.S. Department of Agriculture, 2013

uncertainty and risk. While water transfers are not new<sup>8</sup> – arguably transfers are a basic behavioral response to scarcity when values in use differ – their volumes, scale, frequency, and sophistication are growing in the western United States.

Water transfers in recent years have attracted significant attention in the news and media. However, a majority of the coverage has centered on transfers in which water moves from the agricultural sector to enhance urban or environmental uses. There are several reports about transfers for environmental, municipal, industrial water, or other public benefit; such water transfers are typically better documented than purely agricultural water transfers<sup>9</sup>. While these types of inter-sector water transfers are indeed increasing in scale and scope, water transfer activity strictly within the agricultural sector, or between agricultural producers, is less well documented and understood. The motivation of this report is to improve understanding of the state of water transfers between agricultural producers in the American West, where significant gaps of data and reporting exist. Improving understanding of water transfer activity would provide insights on how the agricultural sector reallocates resources to cope with scarcity and drought, to reduce risk, and in response to long-term economic drivers. Such insights in turn inform water managers and policymakers seeking to identify best practices and avoid potential obstacles in developing management tools and policies to manage agricultural water risk.

Agricultural water transfers in much of the West have been occurring for decades, but are often informal and decentralized. The majority of agricultural water transfers appear to be occurring at a local or regional scale, such as within irrigation districts, canal or ditch companies, or groundwater management districts, called “intra-district transfers.” The approval and reporting process for such transfers, while varied across states and local districts, is generally internal to the local management entity and relatively simple. Few states require that intra-district transfers be reported to the state, meaning that transfer activity is rarely captured at the state, much less federal, level. Transferring water rights outside of an irrigation district, here termed “private water rights transfers,” often does require state approval and reporting, a process that is generally time- and cost-intensive<sup>10</sup>. Because many agricultural water transfers are intra-district and therefore unreported, transfers that are recorded at the state level represent a small fraction of the total activity. Further, intra-district transfers are not relayed to a national database. The total volume and value of agricultural water transfers are thus unknown and likely grossly underestimated in the United States.

The oldest recorded water transfers are over a thousand years old.

<sup>8</sup> S. Zekri and A.S. Al-Marshudi. A millenarian water rights system and water markets in Oman. *Water International*, 33(3):350–360, 2008. DOI: 10.1080/02508060802256120

<sup>9</sup> G. Bennett, N. Carroll, K. Sever, A. Neale, and C. Hartley. An atlas of ecosystem markets in the United States. Ecosystem Marketplace, 2016. URL [http://www.forest-trends.org/documents/files/doc\\_5440.pdf](http://www.forest-trends.org/documents/files/doc_5440.pdf); B. Richter. *WaterShare: Using water markets and impact investment to drive sustainability*. The Nature Conservancy, Washington, D.C., 2016; and L. Szeptycki and D. Pilz. Colorado River Basin environmental water transfers scorecard. Water in the West, Stanford University, 2017. URL [http://waterinthewest.stanford.edu/sites/default/files/Co\\_River\\_Basin\\_Env\\_Transfers\\_Scorecard.pdf](http://waterinthewest.stanford.edu/sites/default/files/Co_River_Basin_Env_Transfers_Scorecard.pdf)

<sup>10</sup> B. Colby, 2018. Personal Communication

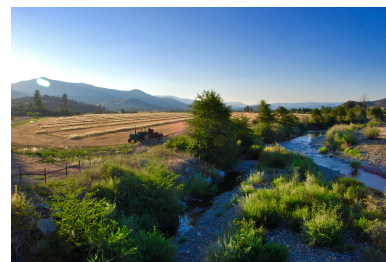
There are several commercial products that are marketed as comprehensive databases of water transactions, such as Water Strategist and the WestWater database. However, in addition to limited public accessibility, these products do not document the majority of informal water transactions, as well as some locally-recorded formal transactions, often showing zero transactions occurring in multiple states with active informal and formal water markets.

The most recent and comprehensive publicly available data on agricultural water transfers at the national level, available from the Farm and Ranch Irrigation Survey in 2008, are now 10 years old and represent a lower bound estimate on transfer activity<sup>11</sup>. In the seventeen western United States, the Survey reported 1,264 agricultural water transfers as occurring within the survey year, totaling 498,918 acre-feet of surface water and groundwater. While the number of transfers and volume are certain to be substantially higher, it is difficult to estimate by how much, given limitations in data. Note that the more recent Farm and Ranch Survey, conducted in 2013<sup>12</sup>, did not publish any water transfer results due to insufficient data.

The findings of this report were informed by interviews undertaken in 2017 with dozens of water users, managers, and policymakers who take part in or oversee water transfers. Interviewees provided information on the variety of water transfers occurring in their geographical area, the challenges that water users and managers face around transfers, the mechanisms for monitoring and enforcing transfers, and the sophistication of data keeping and reporting practices. A list of the interviewees' organizations is provided in the Acknowledgments.

<sup>11</sup> United States Department of Agriculture. *Farm and Ranch Irrigation Survey (2008)*. 2007 Census of Agriculture. U.S. Department of Agriculture, 2009

<sup>12</sup> United States Department of Agriculture. *Farm and Ranch Irrigation Survey (2012)*. 2012 Census of Agriculture. U.S. Department of Agriculture, 2013



## *Typology of Agricultural Water Transfers*

There are many types of agricultural water sharing or transfer arrangements occurring across the western United States. Transfers vary in their formality and in how the water use changes over space and time. The diversity of water transfer arrangements is a reflection of the diverse hydrologic, institutional, and economic conditions in the American West. Descriptions of each type of water transfer arrangement, along with examples, are provided below. Transfer arrangements considered include:

- Permanent transfers
- Leases
- Carryover
- Pooling
- Inter-annual water exchanges
- Rotational agreements
- Recharge

Note that water users may have “water rights,” which are governed by state regulatory agencies; “water allotments,” which are given and managed by canal or ditch companies or irrigation, groundwater, or other water management districts; or “water contracts,” which are given by federal agencies (such as the Bureau of Reclamation) to contractors that are typically large irrigation districts. For simplicity, the following descriptions of agricultural water transfers refer to water rights, although there are analogous transfers for allotments and contracts for several of the transfer arrangements below.

### *Permanent Transfers*

Water rights are generally tied to the land they serve. A permanent transfer refers to moving the water right from the seller’s land to the buyer’s land, in perpetuity, in exchange for a payment. A permanent transfer will require review and approval by the appropriate local, state, and/or federal regulatory agency and is usually recorded through a deed transfer filed at a county courthouse. Some form of permanent water transfers exist in the States of Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming.

For example, in the Elephant Butte Irrigation District of New Mexico, permanent transfers are fairly complicated and require applications, administrative review, public notice, board approval, and recording at the county courthouse.



### *Leases*

Leasing is a borrowing agreement, where the lessor, or the water rights holder, agrees to temporarily give their water right to the lessee for a defined period of time and an agreed upon price. Leases can last for a few months, such as a split-season lease, a full irrigation season, or a multi-year period. Similar to a land or property lease, the water can be used by the lessee per contract terms, but the water right itself remains with the lessor and its use reverts back to the lessor after the contract period. Leases can fall into a simple regulatory framework or a highly complex framework depending on the nature of the water right. Leases can be arranged in advance or during the irrigation season, on-demand in a spot market. Within an irrigation or groundwater management district, leases may be relatively informal, where the lessor and lessee work with their district to review and approve the transfer. In other cases, leases require state-level or even federal review if using federal infrastructure such as canals or reservoirs. Lease transfers are also common in most western states, particularly in local water management districts.

The Edwards Aquifer Authority (EAA) of Texas has an active groundwater leasing program, particularly during drought years in which the EAA can further restrict allocations through a “critical period reduction.” The EAA staff review and approve transfer applications, and monitor and enforce the change in groundwater allocations.

### *Carryover*

Carryover is a mechanism for a producer to reduce water use in one year and make the surplus available in future years. In this case, the producer does not transfer with another producer; they are instead transferring potential current water use to themselves in a subsequent year. Carryover is usually only available in places where inter-annual storage is possible, such as groundwater or a reservoir. In some jurisdictions, carryover is reported but does not require any administrative approval. In other cases, a producer is required to obtain local or state approval.

As an example, the State of Kansas has a “Savings Account Program” available via the Central Kansas Water Bank. Through that program, up to 25 percent of unused allocation can be credited to the following year for use.

### *Pooling*

Pooling is the aggregation and reallocation of water rights across fields. The pooled fields could all belong to the same producer or to multiple producers. In the latter case, there is usually financial compensation commensurate to how water is reallocated. Like carryover, pooling can range in formality from simply being reported to the local agency to requiring state review and approval.

The New Mexico State Engineer’s Office (NMSEO) has “Same Ownership Management” groundwater accounts, which allow pooling of groundwater allocations across different fields. Contrary to the program name, producers can either pool groundwater from their own fields or with those of other producers. The producers report individual groundwater meter readings to the NMSEO, which tracks the individual and total groundwater use. The NMSEO does not require pricing information, but its staff are aware that accounts with multiple owners will usually provide either financial compensation or inter-annual groundwater exchanges.

### *Inter-Annual Water Exchanges*

Unlike a water-for-money arrangement, an inter-annual water exchange is a water-for-water agreement. In other words, an inter-

annual water exchange is a multi-year lease arrangement between two parties who switch roles as lessor and lessee. For example, two producers might agree to pool their water rights, where one gets them in even years and the other in odd years. Or, in another example, two parties with different seniority dates in a prior appropriation system might make an arrangement in which the senior water rights holder gives a portion of their water to the junior water rights holder in drought years in exchange for a portion of the junior water rights holder's water in wet years. Inter-annual water exchanges are used to change the riskiness of a water rights portfolio and reduce the likelihood of reduced water availability in dry years for junior rights holders. The formality of the arrangement depends on the nature of the water right: it could be as simple as working with a local water district or as complicated as working with state or federal agencies.

### *Rotational Agreements*

Similar to inter-annual water exchanges, rotational agreements are water-for-water transactions occurring on a short timescale. Rotational agreements are highly informal and often not explicitly allowed or disallowed through local or state regulation. Instead, rotational agreements often happen in coordination with neighbors on the same diversion structure and sometimes require coordination with the local ditch rider.

### *Recharge*

Recharge is the practice of transforming surface water into groundwater through seepage, percolation, or injection. Recharged water can be used by the individual recharging it or by a neighboring party, in which case there is typically a payment. Recharge practices in most circumstances require the review and approval of a local, state, and/or federal agency, depending on the nature of the water right. Where allowed, there are often rules that discount the amount of water that can be recovered due to losses or groundwater dissipation.

In addition to the Same Ownership Management program in New Mexico, inter-annual water exchanges are also common among contractors, such as irrigation districts, on the State Water Project in California, in which contractors can advantageously arrange water swaps per their seniority dates.

For example, while two water rights may not individually be sufficient to pressurize irrigation equipment or satisfy the crop water requirements of a field, the two rights together could be used to pressurize and use irrigation equipment. A possible agreement between individuals with rotational agreements would be to swap days of irrigation using both water rights, with one individual irrigating on odd days and the other on even days.

Recharge has become a common practice in the Platte River Basin, in which the Nebraska Department of Natural Resources has issued junior water rights to surface water and groundwater districts to recharge excess or flood flows.

*Properties of Agricultural Water Transfers*

The interviews revealed that most types of transfers must explicitly be allowed to occur. Thus, most transfers are regulated, monitored, and enforced in some fashion. Whether through spot checks, energy or flow meters, remote sensing, aerial photography, or diversion structures, the appropriate regulatory agency coordinates with the producers to change or verify the timing and quantity of water deliveries. For example, if two producers have a lease arrangement in an irrigation district, the water master will reduce water diversions to the lessor and increase them to the lessee. If a producer sells all of a private water right, a state agency will use remote sensing, aerial photography, or other monitoring technology to verify that he or she is no longer irrigating. The exception is rotational agreements, which are often so informal that the producers typically do not inform any regulatory or management agency of the arrangement. Indeed, in general, rotational agreements are not explicitly allowed in regulations.

Some local water management jurisdictions only allow one type of transfer. Other jurisdictions have rules and regulations that allow multiple possible transfer arrangements to coexist.

Transfers can move water over space, time, or both. A *permanent transfer* or *lease* moves water use to another location. Changing the timing of water use can occur within an irrigation season (intra-seasonally) or between irrigation seasons (inter-seasonally). *Carryover* makes saved water available to use in another year. In contrast to carryover, in which water use changes inter-seasonally, a *rotational agreement* changes the intra-seasonal use of water. Note that neither carryover nor rotational agreements typically change the location of water use. *Pooling* of water rights can change both the location and intra-seasonal timing of water use. Finally, *recharge* can change the location and inter-annual timing of water use.

The Twin Platte Natural Resources District in Nebraska only allows permanent transfers of groundwater rights. Conversely, a producer in the Sheridan 6 Local Enhanced Management Area in Kansas can pool, lease, or permanently transfer groundwater allocations.

Pooling between multiple wells is common when water rights allocations are determined uniformly and at a well level, such as in the High Plains region. Pooling allows redistribution to address variability in soil type, well yield, and management practices without extensive paperwork needed.

Transfer arrangement	Space	Time	
		Intra-seasonal	Inter-annual
Permanent transfer	•		
Lease	•		
Carryover			•
Pooling	•	•	
Inter-annual water exchange			•
Rotational agreement		•	
Recharge	•		•

Transfers vary in their formality: some can be so informal as to have no paperwork or review required and others as formal as requiring the transfer of a real property right. Transfers could also require multiple levels of reporting. For example, a permanent transfer might require local and state reporting, review, and approval as well as a transfer of the property right. Other transfers, such as leases, might only require one level of reporting, for example at the local level. Note that federal reporting, review, and approval are only required when federal infrastructure, such as storage, pumping stations, or conveyance, is involved in the transfer.

The table shows the formality range of transfer arrangements. A transfer of a formality level that is mutually exclusive is represented by an open dot. Transfers of a formality level that could exist in combination with other formality levels are represented by filled dots.

Type	Formality level				
	No reporting, review, or approval	Local reporting, review, or approval	State reporting, review, or approval	Federal reporting, review, or approval	Transfer of real property right
Permanent transfer		•	•	•	•
Lease		•	•	•	
Carryover		•	•	•	
Pooling		•	•		
Inter-annual water exchange		•	•	•	
Rotational agreement	○	○			
Recharge		•	•	•	

Agricultural producers transfer water in both drought and normal years. Some transfer arrangements, such as leases and permanent transfers, are common while others, such as inter-annual water exchanges, are more unusual. According to several interviewees, leasing, pooling, and short-term water sharing arrangements occur most often in dry years while permanent transfer activity is more closely correlated with economic conditions.

### *Oversight Processes*

Two primary and distinct regulatory processes for agricultural water transfers have emerged: (1) state water agencies, which oversee transfers between private water rights holders and (2) local management districts, which oversee transfers between individuals holding water allotments within those districts.

### *Private Water Rights Transfers*

In the United States, water rights are subject to a number of terms and conditions. Commonly, rights stipulate that water must not be wasted but needs to be used for a reasonable and beneficial use, such as irrigated agriculture. Generally speaking, individuals, companies, tribes, and governmental or quasi-governmental agencies can hold agricultural water rights. In addition to the purpose of use, a water right will typically include other constraints on its use, such as a limit on the instantaneous flow rate, total volume used, diversion point, place of use, purpose of use, and duration of use.

Typically, when a water right undergoes a change, the state must first review and approve the change. An agricultural water transfer will often result in a change in the place of use, ownership, and/or the diversion point. An agricultural water transfer therefore usually requires the producers to file a change application with the appropriate state water resources administration. Most states evaluate change applications on a case-by-case basis to determine whether the change will impair other water rights holders in the system. State officials often examine whether a water right change will enlarge irrigated acres, increase consumptive use, place new burdens on delivering water to existing water rights holders (e.g. reducing “carrying water” or exceeding maximum conveyance capacity), or conflict with the timing or volume of instream flow needs. While most water rights transfers are handled administratively through the state water resources department, some states require public notice of any proposed water rights transfer (New Mexico, Oregon) or court approval (Colorado).

Most western states use the prior appropriation doctrine for surface water rights administration. The prior appropriation doctrine fills water rights on a “first come, first served” basis. In times of drought or water scarcity, water users are cut off in reverse order of their seniority. Curtailment under prior appropriation disproportionately affects junior water rights holders, who therefore often participate in water transfers as buyers or lessees. Buying or leasing a more senior water right is a common strategy for relatively junior water rights holders to reduce their drought-related water risk.

During the change application or transfer process, most states do not change the seniority date of a water right. The seniority date of a water right is a feature of its security and often plays a strong role in determining its value. There are some instances when state reporting is required but ignored because the individuals transferring water rights are either unaware of the process or willfully disregard it due

Changes can include a combination of change of ownership, purpose of use, place of use, and diversion point.

For example, during a water shortage, a water right with a priority date of 1890 would be much more secure than a water right dating to 1960. The water right holder with the 1960 priority date would be curtailed entirely before the water right holder with the 1890 priority date experienced any curtailment.

The State of Wyoming has an unusual rule for agricultural water leases. Temporary transfers do not retain the seniority of the water right leased. Rather, leased agricultural water in Wyoming becomes the most junior right on the system. The loss of seniority likely devalues water to potential lessors and lessees, which could be a large factor for why there are very few temporary agricultural water transfers in Wyoming.

to high transactions costs and low enforcement likelihood. This outcome generally only happens for more informal and temporary water transfers, such as rotational agreements. However, there are some permanent water sales that occur as part of land or farm transactions that go unreported to state agencies. Permanent water transfers have the most variation in reporting and review requirements, but most often, it is county courthouses and not the state water resources department that hold records of current water rights ownership. Most individuals buying bundled land and water rights will register the deed at the courthouse, but are unaware of reporting guidelines with the state with respect to changes in water rights ownership. Therefore, many states do not have up-to-date ownership records despite regulations.

### *Intra-District Transfers*

Most agricultural water transfer activity appears to be intra-district. There are two reasons for the prevalence of intra-district transfers: (1) there is legally no change in the water right from the perspective of the state, and (2) the state has delegated the authority for management to a local entity. It is common, especially for groundwater, to have local districts manage the resource, monitor and enforce use, and approve transfers.<sup>13</sup>

Just as an individual can hold a water right, so too can an irrigation district, ditch, or canal company. Such a water right will also have a diversion point, purpose of use, place of use, diversion period, maximum flow rate, and maximum volume. Unique features of a district water right are that (1) its place of use generally covers the land within the district's entire management area, and (2) it can be multi-purpose to cover the variety of water uses within the district such as irrigation, stockwater, domestic, and industrial use. Agricultural water users in the district then have shares in the total water right, typically based on irrigated area, and an allotment per share. For instance, a water user might have an allotment of 3 acre-feet per irrigated acre on 100 acres of land, for 300 acre-feet total.

Districts have worked through membership services, rates and assessments, and rules and regulations. This means that quantification of the water right is complete, even if it is through coarse or proxy units such as irrigated area. Water users in an irrigation district are not themselves water rights holders, but members of the district that holds the water right. There is no system of seniority, as they share the same water right. Thus there are no tests around injury or prior appropriation in a transfer. Finally, because the place

Improving understanding of such regulations with real estate agents and brokers, as well as county clerks, would improve water rights records at the state level.

As examples, Kansas *Groundwater Management Districts*, Nebraska *Natural Resources Districts*, Texas *Groundwater Conservation Districts* and the *Edwards Aquifer Authority*, and Arizona *Active Management Areas* are all local districts with the authority to manage privately held groundwater rights and the transfers between rights holders. The newly formed *Groundwater Sustainability Agencies* in California should function similarly.

<sup>13</sup> C. Babbitt, M. Hall, A. Hayden, A.L. Garcia Briones, R. Young, and N. Brozović. Groundwater trading as a tool for implementing California's Sustainable Groundwater Management Act, 2017. URL <https://edf.org/WaterTrading>. Environmental Defense Fund and Mammoth Trading

of use is defined as the irrigation district's boundaries, transfers between the district's members do not invoke state requirements for individuals to apply for a change of place of use of a water right. A handful of states require irrigation districts to notify the relevant state agency of transfers but, to the best of our knowledge, only Oregon requires state-level departmental review and approval of intra-district transfers. These features make it particularly easy for agricultural producers to trade water internally within their districts.

### *Considerations for Transfer Programs*

The interviews highlighted several key issues for transfer programs:

- The challenges of quantifying and regulating water use
- The variety of standards for recording and reporting transfer data
- The potential involvement of third-parties in transactions
- The variety of transfer instruments and their associated transactions costs
- The importance of strong water rights administration

### *Quantification and Regulation*

The quantification of a water right and regulation of its transfer are generally more complicated for privately held water rights (private water rights transfers) compared to water allotment transfers within an irrigation district or canal company (intra-district transfers). Despite the fact that most privately held water rights have quantifiable limits, such as maximum withdrawal amount, several states have not historically measured individual diversions or estimated their consumptive use. As a result, a water rights transfer based on the maximum withdrawal or diversion limits potentially could increase consumptive use. Most states have an obligation to ensure that transfers cause no harm or injury to existing water rights holders, which creates the need to estimate the historical consumptive use of the water right in question. The amount of the water right that can be transferred is often limited to the historical consumptive use regardless of the theoretical maximum diversion. Quantifying water rights for the purpose of transfers has been a significant obstacle. There are steep costs to hire engineers, attorneys, and other professionals to estimate a water right holder's use with the best available data.<sup>14</sup> There are often adjustments, conditions, or other modifications to the water right through the transfer process to mitigate third-party impacts.

Best available data could include a combination of energy data, telemetry and remotely sensed data, crop insurance records, and flowmeter data when available. Although remote sensing of crop evapotranspiration offers the potential for rapid and cheap water rights quantification, significant uncertainty and potential measurement errors remain with these methodologies.

<sup>14</sup> T. Foster, I.Z. Gonçalves, I. Campos, C.M.U. Neale, and N. Brozović. Assessing landscape scale heterogeneity in irrigation water use with remote sensing and in-situ monitoring. *Environmental Research Letters*, 2018. URL <http://iopscience.iop.org/10.1088/1748-9326/aaf2be>

This process can be particularly cost- and time-prohibitive for short-term transfers such as leases. In basins that have been adjudicated, or in which the state courts have systematically quantified and verified water rights, transfers are often much simpler.

Irrigation districts do not face the same challenges as private rights holders around quantification, as they generally do not have the same statutory requirements to ensure no injury or harm as a result of water transfers. However, districts are accountable to their members and generally do have rules to quantify water transfers and ensure that any needed changes in the timing or routing of transferred water will not exceed the capacity of the conveyance infrastructure (e.g. carrying water, canal capacity). There is a wide variety of sophistication among districts in quantifying, monitoring, and enforcing water deliveries.

The most common unit for water transfers is irrigated acres. Even in regions where a volumetric right or allotment is available, transfers are usually done on an acreage basis.

### *Recording and Data Availability*

There is a large degree of variation in the recording practices for water transactions, particularly among irrigation districts and ditch companies. In some cases, there is no recording whatsoever; the parties inform their water master or ditch rider, who changes diversions appropriately but without record. In other cases, individual records are updated where the seller's/lessor's water account is deducted and the buyer's/lessee's water account is credited appropriately. In this case, there is generally no centralized database and tracking is difficult because there are no notes or indications matching the parties. Some irrigation districts maintain a centralized database of transfers, and a smaller number report transfers to the state water resources agency. Where transfers are tracked, records typically include information about the buyer/lessee, seller/lessor, the amount of water transferred, and the duration of the transfer. While rare, there are instances of local water districts or agencies collecting price information (e.g. Mojave Water Agency, Central Platte Natural Resources District) or even setting prices (e.g. Central Kansas Water Bank, Idaho Water Supply Bank). A handful of local water districts, while allowing transfers, discourage financial compensation beyond assuming the fees and taxes associated with additional water deliveries (e.g. Kittitas Reclamation District in Washington State).

Most local and state regulatory agencies do not collect data on the prices or values of water rights transfers, as they do not view such

In some districts, water deliveries are not measured at all; other districts measure deliveries in units of time (irrigated hours or days), while others measure irrigated areas (acres); still others use the volume of water (acre-feet).

For example, a water right of 3 acre-feet per acre on 100 acres represents a total of 300 acre-feet. However, if it is a junior water right, or a pro-ratable allotment that is subject to reductions based on scarcity conditions, the water right may be reduced to 1 acre-foot per acre in dry years. The seller/lessor cannot guarantee 300 acre-feet, and therefore transfers the water right based on irrigated acres, which may be subject to change, a risk that the buyer/lessee carries.

In thin markets, it would be possible though labor-intensive to back out transactions between individuals. In thicker markets, such tracking would not be feasible.



information as fundamental to their role in monitoring and enforcing water use. For some of those agencies that collect prices, there may be questions about the quality or accuracy of the data as transaction prices are self-reported.

Price setting for agricultural water transfers is rare in private water rights trading but fairly common within intra-district trading, particularly for irrigation districts that contract water with the Bureau of Reclamation. The Idaho Water Supply Bank (IWSB) allows private water rights holders to request specific rates for water leases, but it is left to the Idaho Water Resources Board to determine if the rate is appropriate. The IWSB has an established rate structure, but producers will often work outside of the IWSB through a broker to get a better price. Similar examples of price setting for private water rights exist in Colorado, Kansas, and Nebraska. Price setting is more common within irrigation districts, where districts may offer a fixed price to members who wish to lease their water allotment. Unused water allotments are offered to other members in the district (e.g. Arvin Edison Irrigation District in California) or sold to another irrigation district, contractor, or water user (e.g. Sunnyside Valley Irrigation District in Washington State, Buena Vista Water Storage District in California). Note that inter-district transfers typically involve state and federal oversight, as the transfer necessitates a change in the place of use. Districts sometimes institute a price premium to cover administrative and operational costs of transfers, but some districts have charged up to 200 percent of the price that members receive (e.g. Buena Vista Water Storage District in California).

Permanent water transfers, particularly among privately held water rights, are often recorded at county courthouses and usually are tracked by the State agency through applications or a water rights registry. Some State agencies and local jurisdictions (groundwater management districts, irrigation districts) maintain a centralized transfer database, which will generally include information such as the buyer and seller identities, the volume of the water rights transfer, and any changes in the place, purpose of use, and point of diversion. Fees and assessed taxes associated with the water right move to the buyer, but the price or value of the water transaction is rarely required or recorded.

Water transfer data, including transfer databases, are generally not publicly or easily available, but are discoverable if the agencies are public (State agencies and some irrigation districts). Private ditch companies are not compelled to share information on internal water transfers; in some states, private ditch companies make up the ma-

In interviews, some of the agencies described producers' "reluctance to share" price data and suspected that many wrote fictitious prices. Others described initial hesitation to report prices but a growing level of comfort over time.

In interviews, some agricultural producers noted that (1) fixed pricing, particularly in drought years, and (2) irrigation districts working as trading intermediaries, had discouraged participation in water trading, as both elements worked to deflate the prices that producers received for their allotments.

In common between state and local water agencies, most management staff see their role as monitoring and enforcing water use and not involvement in private business decisions or the economics of traded water.

majority of surface water rights ownership, meaning that a significant portion of water rights transfer data is outside the public realm.

### *Third-Party Involvement*

In addition to the direct regulatory agencies that review and approve transfers, which include irrigation districts, ditch companies, and state agencies, there are typically several other third parties whose involvement is required for a water transfer. These might include water courts to review and approve transfers, county courts and clerks to record transfers, notaries to certify contracts and legal documents, the public during notice or protest periods, title companies to check title and verify ownership, and brokers, aggregators, auctioneers, or other market administrators to match trading parties.

### *Transfer Instruments and Transactions Costs*

Depending on the nature of the water right, the mechanism for identifying interested parties with which to transfer, and the formality of the process, transferring water can be relatively simple and inexpensive or highly complicated and expensive. Generally speaking, intra-district transfer programs represent the overwhelming majority of agricultural water transfers; search and negotiation costs associated with transfers are highly variable. Producers enter into bilateral contracts that they themselves negotiate, and contact the local ditch rider or administrative staff to make the appropriate changes with a simple phone call requesting a transfer. Other districts require an application for transfers that is reviewed and approved by either the administrative staff or the district's board of directors. Most districts will review and approve transfers at no cost, while others charge a nominal administrative fee.

While most transfers are organized through decentralized and informal processes, some are facilitated through brokers, auctioneers, or other market administrators. Bulletin boards exist in many jurisdictions and can be either physical (e.g. a legal pad in a district office) or electronic (e.g. a website). Bulletin boards allow individuals to self-identify as interested in trading, and they are usually maintained by the regulatory agency. There are a few examples of electronic clearinghouses matching parties to trade. Privately run platforms will typically charge a fee, while publicly run platforms are developed at cost to the regulatory agency and are available to use for free (e.g. Central Platte Natural Resources District in Nebraska). Some platforms are developed at cost to the regulatory agency and also charge a fee (e.g. Fox Canyon Groundwater Man-

agement Agency in California). Fees for transfer programs range from zero to upwards of seven percent.

In transferring privately held water rights, agricultural producers and the state alike may incur high costs. The producers are often required to pay state application fees, hire engineers who can evaluate the historical consumptive use of the water right, and hire attorneys for legal advice. The state also incurs high costs in the form of staff time, as transfers are often evaluated on a case-by-case basis. In Colorado, a water court oversees and approves transfers of privately held water rights. Transactions costs represent a high barrier for agricultural producers, with the result that only wealthy producers or other users of water, such as municipal and industrial uses, can afford to execute transfers.

### *Administration*

There is a broad misconception among water users that strong water rights administration, or the willingness to monitor and enforce water rights and diversion limits, represents a threat to individuals' water security. Through the interviews, it was apparent that the opposite is true: weak water rights administration, including a lack of monitoring and enforcement, weakens water security and the value of water rights. There were several examples where states were not adequately regulating water diversions: if a regulator fails to ensure that upstream users do not take more than they are allowed, downstream users could be unfairly deprived of their water rights. On the other hand, if a regulator fails to ensure that users downstream do not take more than they are allowed, this limits the ability of upstream users to lease or sell their water rights, as there is no guarantee these rights would be physically available to the downstream purchaser and would not be diverted by another junior or downstream user. Strong monitoring and enforcement of water rights increases both water security and the value of water rights.

### *Moving Forward*

Agricultural water transfers have been an important aspect of risk management in the American West for decades. Water transfers emerged organically in response to binding limits on water use and changing crop needs relative to water rights availability and seniority. Water transfers remain an important aspect of risk management for agricultural producers, who use transfers to adjust to long-term economic drivers and to respond to short-term water supply fluctua-

One pilot program in Colorado, called the *lease fallow tool*, is attempting to reduce transactions costs by allowing streamlined administrative approval of leases in exchange for a 10 to 12 percent offset, or automatic reduction of the water right. This program is being piloted by the Lower Arkansas Valley Water Conservancy District and the Lower Arkansas Valley Super Ditch Company with the possibility to scale if successful. While the offset does represent a transaction cost to producers, the expectation is that the offset represents a lower cost to producers than the costs incurred through water court review.

tions.

While water transfers have been an important tool for agricultural producers, activity and participation are impeded by a number of practical obstacles, namely (1) quantification of water rights and (2) administrative evaluation. Quantification of a water right is relatively straightforward within irrigation districts, but private water rights holders in many cases must provide evidence to quantify their water rights with electricity records, crop insurance, or other available data. Sellers and lessors face high degrees of risk in quantifying their water rights, which may turn out to be much less than expected, and both parties invest large sums of time and money into a transfer process that has no guarantee of approval. Furthermore, private water rights holders often must navigate a complex regulatory process at the state level. Many states have substantial but opaque injury tests around impacts to third parties and environmental flows, and include a public notice and protest period that delays the process.

Quantification and administrative evaluation processes serve important functions to verify that transfers do not result in adverse impacts such as increased consumptive use. However, states could improve and expedite the process in a way that does not jeopardize the review process, but strengthens it. In particular, states could systematically adjudicate, or evaluate, water rights and improve monitoring and enforcement. Doing so would remove the burden of quantification from individual water rights holders and provide consistency of quantification across water rights. Furthermore, transfer criteria today are most often evaluated on a case-by-case basis, which is a time-consuming and costly process for both water rights holders and water regulators. State water agencies are generally understaffed, generating significant backlogs of transfer applications. Instead, states could expedite the process and reduce their own costs and those of water rights holders by creating a science-based, transparent, and systematic approach to evaluating transfers and ensuring non-injury.

The interviews conducted as part of this report revealed the diversity and range of formality of agricultural water transfers. The interviews further revealed how common water transfers between agricultural water users are despite going relatively unnoticed in existing literature and media coverage. This implies that agricultural water transfers currently provide unnoticed resilience and risk management to producers and their irrigated agricultural enterprises.

The majority of transfer activity appears to be happening within local management districts, such as irrigation districts. To improve

### *Key challenges*

- Data collection and information on agricultural water transfers – particularly intra-district informal transfers – are very limited so that the total volume and value of water transfers are unknown
- Misconceptions around the terminology of ‘water transfers’ and ‘water markets’ are prevalent: many active participants in transfers don’t acknowledge what they’re doing as such
- Water transfer mechanisms have emerged organically, locally, and independently; as a result
  - the same type of transfer often has multiple names (e.g. pooling, carryover, and carryforward; banking and flex accounts)
  - the same name can signify very different transfer mechanisms (e.g. banking)

### *Key Opportunities*

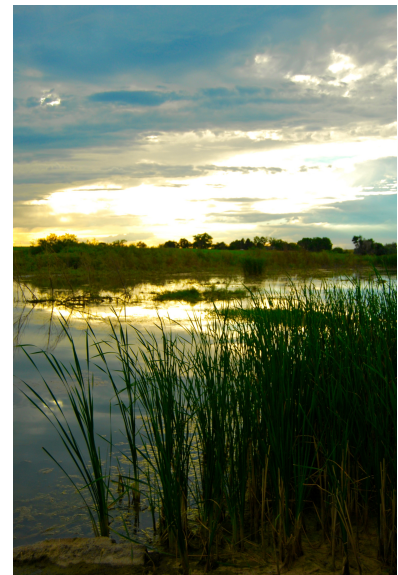
- Sharing of information about potential transfer types and their implementation is a cheap pathway to scaling water transfer activity across hydrological and jurisdictional boundaries
- Education on the value of strong property rights and their enforcement is a prerequisite for wider adoption of transfer mechanisms
- In simple regulatory settings, the introduction of expedited transfer mechanisms could provide an additional risk management tool, particularly for smaller agricultural producers

data on water transfer activity, state or federal government agencies could request that such districts share available transfer data. However, many districts do not record transfers through an explicit database, but simply update water allotment records, which would present a significant challenge to capture. Further, many water districts are privately run, such as ditch or canal companies, and not public agencies. Private ditch and canal companies are much less likely to share water use and transfer data with the state or federal governments and have no obligation to do so.

The United States Department of Agriculture's Farm and Ranch Irrigation Survey is one of the few public instruments to collect water transfer data. However, even this survey instrument has only captured a small fraction of the transfer activity. The survey could be significantly expanded and refined to account for other water sharing arrangements and transfer activities. In addition, there is an opportunity to request the data from irrigation districts directly. Improving public data on the volume and value of water sharing arrangements would be a first step to understanding water transfer behavior associated with droughts and changing economic conditions, learning and scaling best practices of transfer programs, and improving public policy at the federal, state, and local levels to reduce transactions costs to agricultural producers.

### *Summary*

A key objective of this report is to improve understanding of the variety of informal and formal water transfers occurring for agricultural production, to describe the transfer processes and considerations for managers and decision makers considering new transfer programs, and to discuss challenges and opportunities both to scale transfers and to improve data collection. Water transfers between agricultural producers are widespread in the Western United States, implying that such transfers provide both value and risk management to voluntary participants. Most water transfers seem to be informal and occur at a local, within-water district level. Current data collection about transfers is limited and some common types of transfers generate no recordkeeping at all. Moreover, the terminology used for transfers is localized and variable: often water transfer participants do not self-identify as undertaking water transfers. The analysis highlighted the potential benefit of sharing clear information about potential transfer types and their applicability, as well as the need to emphasize the role of well-defined property rights with strong enforcement in building trust for water transfer activities.



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