USDA Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

Economic Research Service

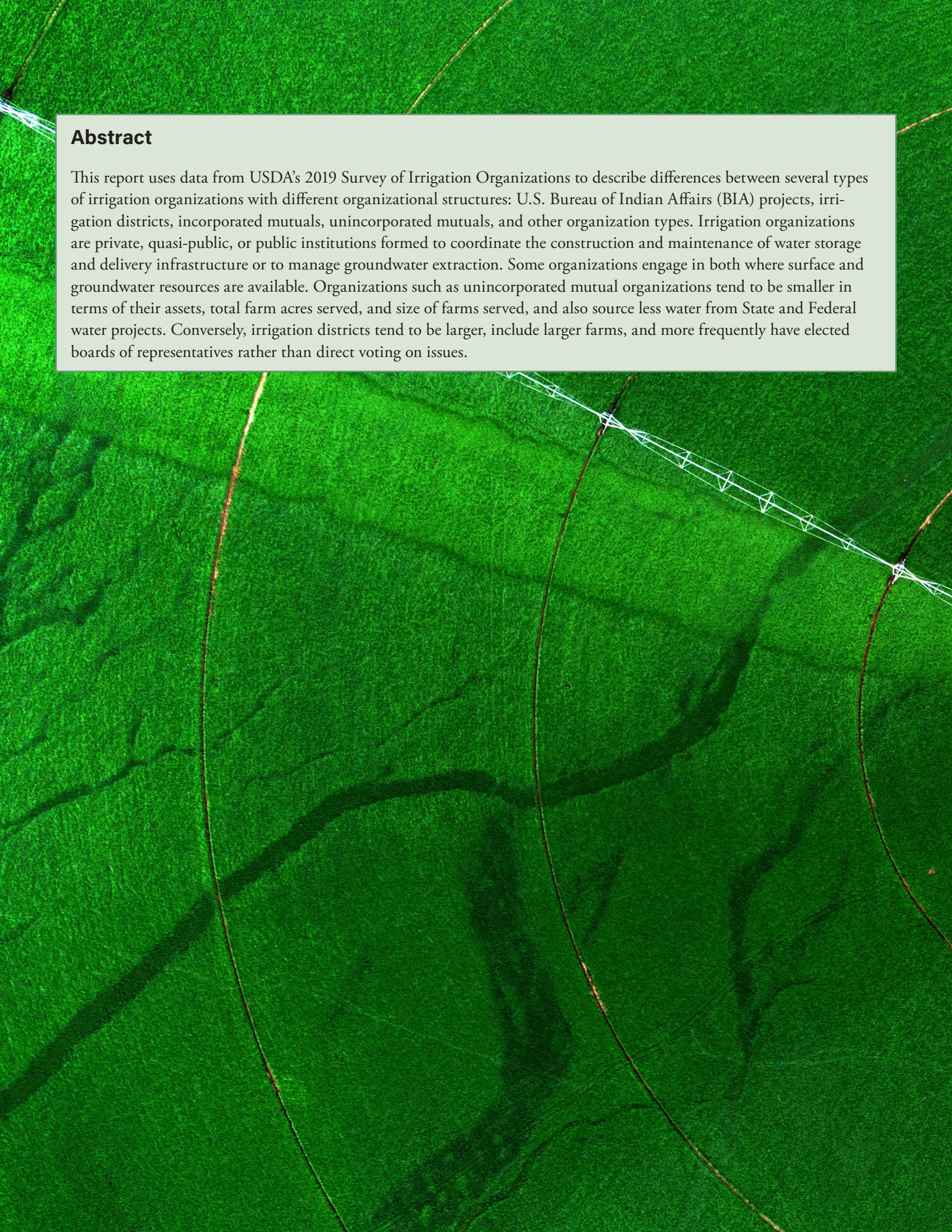
Economic Brief Number 45

September 2025

Irrigation Organizations:

Organization Types and Governance

Nicholas A. Potter, R. Aaron Hrozencik, and Steven Wallander



Abstract

This report uses data from USDA's 2019 Survey of Irrigation Organizations to describe differences between several types of irrigation organizations with different organizational structures: U.S. Bureau of Indian Affairs (BIA) projects, irrigation districts, incorporated mutuals, unincorporated mutuals, and other organization types. Irrigation organizations are private, quasi-public, or public institutions formed to coordinate the construction and maintenance of water storage and delivery infrastructure or to manage groundwater extraction. Some organizations engage in both where surface and groundwater resources are available. Organizations such as unincorporated mutual organizations tend to be smaller in terms of their assets, total farm acres served, and size of farms served, and also source less water from State and Federal water projects. Conversely, irrigation districts tend to be larger, include larger farms, and more frequently have elected boards of representatives rather than direct voting on issues.

Acknowledgments: The authors thank the team at USDA, National Agricultural Statistics Service for their work in designing and conducting the 2019 Survey of Irrigation Organizations. This report benefited significantly from comments from Marcel Aillery and anonymous reviewers. We also thank Jeff Chaltas, Grant Wall, and Chris Sanguinett of USDA, Economic Research Service for editorial and design support.

About the authors: R. Aaron Hrozencik, Nicholas A. Potter, and Steven Wallander are research agricultural economists with USDA, Economic Research Service.

Summary

Irrigation organizations can be classified according to their governance structures, which reflect different approaches to managing water resources and building the infrastructure necessary to apply water for irrigation. Irrigation organizations that are communities of local irrigators created acequias[1] in New Mexico and Colorado. In other cases, private for-profit or non-profit companies formed irrigation organizations as incorporated or unincorporated mutual organizations to allow for investment or allow members to pool resources. Additionally, in many western States laws provided for the establishment of irrigation districts, which were public or quasi-public institutions with powers to levy fees and raise capital by issuing bonds. Irrigation districts often contract most of their water supplies from State or Federal water projects. The U.S. Department of the Interior, Bureau of Indian Affairs (BIA) also created irrigation projects to facilitate irrigation on reservation lands. Finally, where groundwater supplies make collective action to construct water diversion, storage, and conveyance infrastructure unnecessary, irrigation organizations focus instead on monitoring and coordinating groundwater extraction levels and conserving water resources for future use. These different solutions to water resource management resulted in substantial differences between these organizations, reflected in their size, voting structures, and assets. These differences inform how irrigation organizations approach water security issues facing irrigators today.

In this report, organizations are sometimes grouped by the size classifications used in USDA, National Agricultural Statistics Service (NASS) (2020). Small organizations are those serving less than 1,000 acres, medium organizations serve between 1,000 and 10,000 acres, and large organizations serve more than 10,000 acres. These size classifications reflect service areas in 2019 and, therefore, depend on water conditions in that year. This report truncates some values at the 10th and 90th percentiles to reduce the influence of outliers. Summary statistics may differ from those in USDA, NASS (2020) as a result.

This report is the sixth and final in a series that draws on data from the USDA's 2019 Survey of Irrigation Organizations (SIO) to provide statistics on key topics related to irrigation organization types and their role in irrigated agriculture in the United States. In the 2019 SIO, irrigation organizations that deliver water to members were grouped into unincorporated mutuals, incorporated mutuals, irrigation districts, BIA projects, and other water delivery organizations (see table 1 and the "2019 Survey of Irrigation Organizations Organization Types" box for more information). Groundwater organizations coordinate or monitor groundwater resource use and may also deliver water to members.

To summarize key differences between these types of organizations, which is an important factor in making water management decisions, this report addresses some fundamental questions:

- What key differences in scale (i.e., acres served, farm size, assets, and conveyance infrastructure) and water sources exist between private or communal organizations and public or quasi-public organizations?
- How does the prevalence of voting mechanisms vary between different organization types?
- How do organization types differ in their asset composition and the volumetric pricing of water and other fees charged to their members?

[1] Acequias are community maintained and operated waterways with the primary goal of irrigation that initially developed in the former Spanish colonies in the United States.

Key findings from this report include:

- For organizations that reported conveyance infrastructure, unincorporated mutuals were the smallest type of irrigation organization, serving an average of 519 acres and farms with an average size of 43 acres, whereas irrigation districts were the largest non-Federal irrigation organization, serving an average of 10,480 acres with an average farm size of 118 acres.
- State and Federal water projects were the only source of water for 38 percent of large irrigation organizations (serving more than 10,000 acres), 20 percent of medium-sized organizations (serving between 1,000 and 10,000 acres), and 14 percent of small irrigation organizations (serving less than 1,000 acres).
- Direct voting is most common in unincorporated mutuals and incorporated mutuals, with 57 and 75 percent of organizations making some decisions by direct votes of their constituent members.
- Among organizations with an elected board of representatives, 67 percent of unincorporated mutuals allocate one vote per user and 72 percent of incorporated mutual organizations allocate votes proportional to land, water, or share; while irrigation districts are more mixed, with 43 percent allocating votes proportionally.
- About a third (30 and 33 percent, respectively) of small and medium unincorporated mutual organizations had assets that exceeded $150 per acre, compared to between 55 and 36 percent, respectively, of incorporated mutuals and 40 and 57 percent, respectively, of irrigation districts.
- Financial reserves comprised 23 percent of total irrigation district assets but only 7 and 8 percent of incorporated and unincorporated mutual organization assets.
- Irrigation organizations charged between $10 and $136 per acre-foot of water delivered to users and assessed between $26 and $51 per acre.

Overview of Irrigation Organization Types

Irrigation in arid regions like the western United States[2] often requires substantial infrastructure investment to move water from surface water bodies to farmland. The dams, reservoirs, ditches, canals, and pipelines necessary to divert, store, and convey surface water to farmland present substantial costs that generally require coordinated action (Coman, 2011; Ostrom, 1990; Ostrom & Gardner, 1993). Irrigation organizations facilitated pooling resources for infrastructure construction, management, and operation to deliver water to farms (Hanemann, 2014; Libecap, 2011; Ostrom, 2011). Where extensive groundwater supplies made direct pumping of water more economic than constructing water delivery and storage infrastructure, irrigation organizations largely developed to coordinate and manage groundwater supplies. In some regions where both groundwater and surface water resources are available, irrigation organizations may both deliver water and manage water delivery and storage infrastructure and manage groundwater extraction.

Irrigation organizations can be considered part of a set of multilevel institutions governing water use.[3] Today, irrigation organizations include a range of private, public, and quasi-public institutions that manage water resources, coordinate groundwater and surface water use, construct water storage and conveyance infrastructure, and deliver water to constituent users. Increasing drought frequency and severity present additional challenges to water management (Dettinger & Anderson, 2015; Lehner et al., 2017; Liu et al., 2017; Schaible & Aillery, 2017). Irrigation organizations have an important role to play in efforts to mitigate the impacts of water scarcity and drought (Wallander et al., 2022).

Different types of irrigation organizations formed in response to the resources needed to construct the necessary delivery and storage infrastructure and the ability of communities, cooperatives, private companies, and local, State, and Federal governments to marshal those resources (Leonard & Libecap, 2019; Nunn, 1985). Legal institutions and cultural norms also played a role in the type of irrigation organization that were created and their governing structure in terms of voting and boards of representatives (Ostrom & Gardner, 1993; Seabright, 1993). Where the resources needed to construct an irrigation project were relatively small, irrigation organizations took the form of mutuals or ditch companies (Hutchins, 1929). In New Mexico and southern Colorado community organizations in Spanish settlements developed acequias as early as the 1600s to manage water resources and conveyance infrastructure (Hutchins, 1928; Simmons, 1972). In Utah, Mormon settlements organized extensive community-based irrigation works (Wescoat, 2023). Larger irrigation projects required more resources, involving the construction of storage infrastructure, dams, canals, and pipelines. Irrigation districts were created as public or quasi-public institutions and are empowered to issue bonds and levy taxes to meet these needs, often working with a larger State or Federal water project (Hutchins, 1931; Nunn, 1985).[4]

In the 2019 Survey of Irrigation Organizations (SIO), organizations were asked to classify themselves according to organization type, which to some degree encapsulates these different types of irrigation organization, shown in table 1 (see the "2019 Survey of Irrigation Organizations Organization Types" box for more information).

[2] The Western United States consists of 11 States: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. These States encompass the Pacific, Northwestern, and Eastern Rockies regions defined by the USDA, National Agricultural Statistics Service's summary of the 2019 Survey of Irrigation Organizations (SIO) (USDA, National Agricultural Statistics Service, 2020). For more information on these regions related to the 2019 SIO, see the "USDA 2019 Survey of Irrigation Organizations" box.

[3] Multilevel institutions in the sense used by Moss and Newig (2010), which emphasizes a mesh of institutions at the community, regional, State, and Federal level, and the importance of scale in terms of water basins and water projects.

[4] For example, the California Irrigation District Act was passed in 1917, allowing the formation of irrigation districts. The Central Valley Project was decades in the making but initially approved for funding by the U.S. Bureau of Reclamation in 1933.

Table 1
Irrigation water delivery organization types

Delivery organization type	Survey of Irrigation Organizations definition
Bureau of Indian Affairs (BIA) project	Irrigation projects and systems operated by the U.S. Bureau of Indian Affairs (USBIA), which primarily serve farms on American Indian reservations
Irrigation district	A public corporation or special-purpose governmental unit, which can make use of taxing powers with statutory authority to assess taxes and/or fees for water delivery
Incorporated mutual	A legal entity owned by shareholders who use a water conveyance system
Unincorporated mutual	An informal partnership among ditch users. This is typically a partnership or informal group of two or more farmers who operate irrigation supply works for their own needs. Many operate with no official formal organization
Other organization type	Organizations that do not consider themselves as one of the other organization types

Source: USDA, National Agricultural Statistics Service (2020).

Some organizations surveyed in the 2019 SIO are groundwater organizations (organizations engaged in groundwater management) rather than water delivery organizations (organizations that deliver irrigation water to their constituent members).[5] Because groundwater does not generally require collective investment in diversion and conveyance infrastructure, groundwater organizations have different priorities from irrigation water delivery organizations. In most cases of groundwater use, individual farmers install groundwater pumps and decide how much water to extract for irrigation, which can lead to overextraction and increased pumping costs for others. As a result, economic incentives to extract groundwater can make long-term management difficult if some method of limiting extraction is not implemented (Allen & Smith, 2023; Ayres et al., 2021; Blomquist, 1988; Wohlers et al., 2014). Groundwater organizations try to solve this coordination problem, focusing on managing and monitoring groundwater resources and sometimes coordinating groundwater extraction rates between users (Edwards, 2016; Hrozencik et al., 2023; Provencher & Burt, 1993). Partly because of these different objectives, groundwater organizations differ in their organizational structure, assets, and available strategies (e.g., groundwater organizations usually cannot legally restrict users from pumping groundwater in the way that an irrigation organization may be able to) from irrigation water delivery organizations.

Results from the 2019 SIO (see the "USDA 2019 Survey of Irrigation Organizations" box) reveal differences between types of irrigation organizations that reflect the historical context in which they were created. Public and quasi-public organizations, such as irrigation districts, tend to service larger acreage and depend more heavily on water resources contracted from Federal or State water projects. On the other hand, private and community-based organizations are characterized by smaller total acreage, greater dependence on direct diversions of water from surface water bodies, and smaller farms.

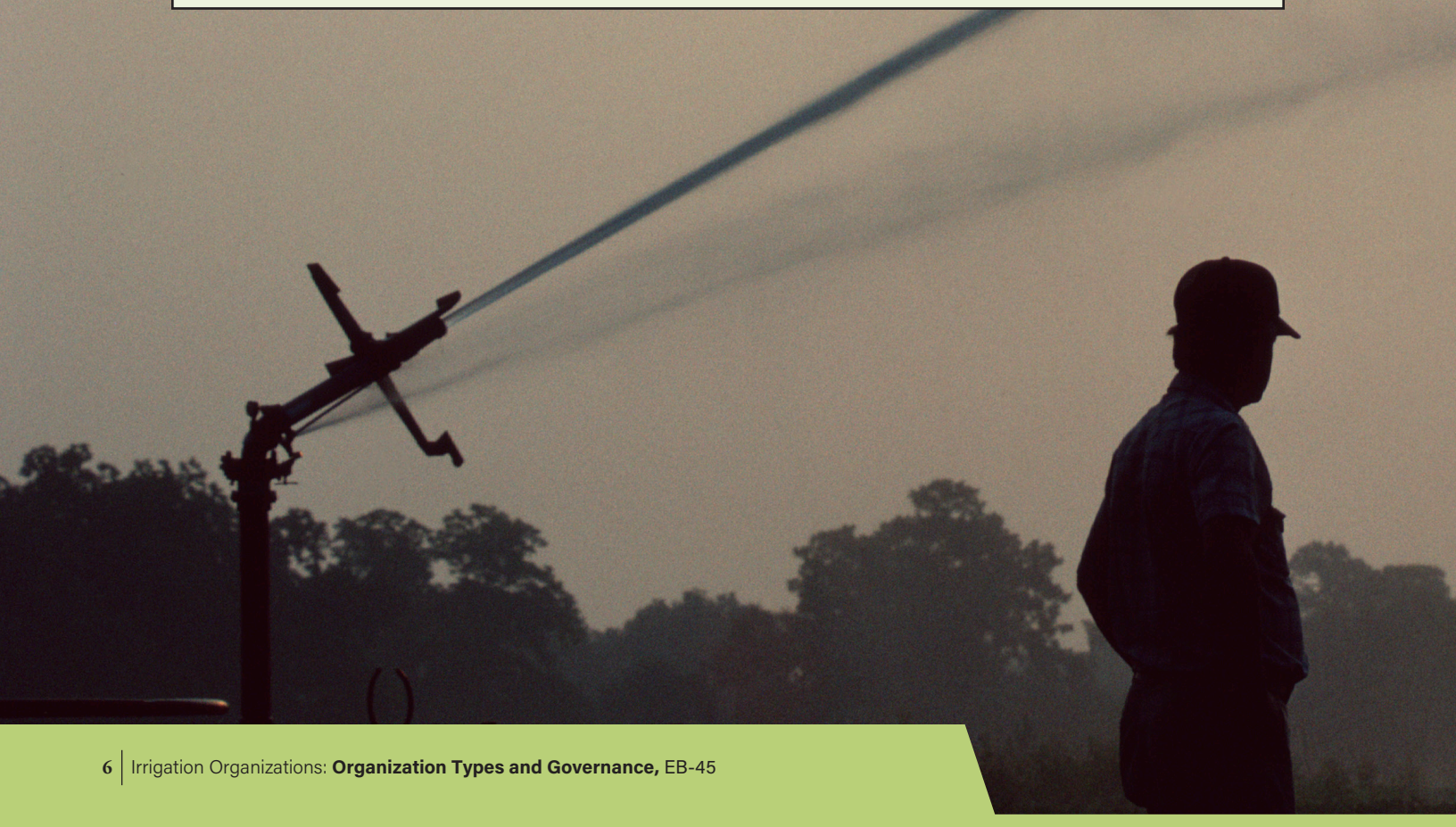
[5] This follows the terminology established in Potter et al. (2023), which distinguishes between irrigation organizations that deliver water from any source to their constituent users and organizations that coordinate or manage groundwater extraction by users but do not deliver water. Organizations that both deliver water and manage groundwater are classified as irrigation water delivery organizations but are also included in groundwater organization statistics. About 5 percent of water delivery organizations also manage groundwater resources, which comprise about 2 percent of total water sources.

USDA's 2019 Survey of Irrigation Organizations

The USDA's 2019 Survey of Irrigation Organizations (SIO) collected data on irrigation organizations in 24 States within the western, southeastern, and Mississippi Delta regions of the United States, where these organizations are most common (see box figure 1). The SIO was a collaboration of the following USDA agencies: Economic Research Service (ERS), National Agricultural Statistics Service (NASS), and the Office of the Chief Economist (OCE). The SIO was primarily funded through a congressional budget initiative aiming to expand research and data on agricultural drought resilience. A summary of these results was published by USDA, NASS (2020).

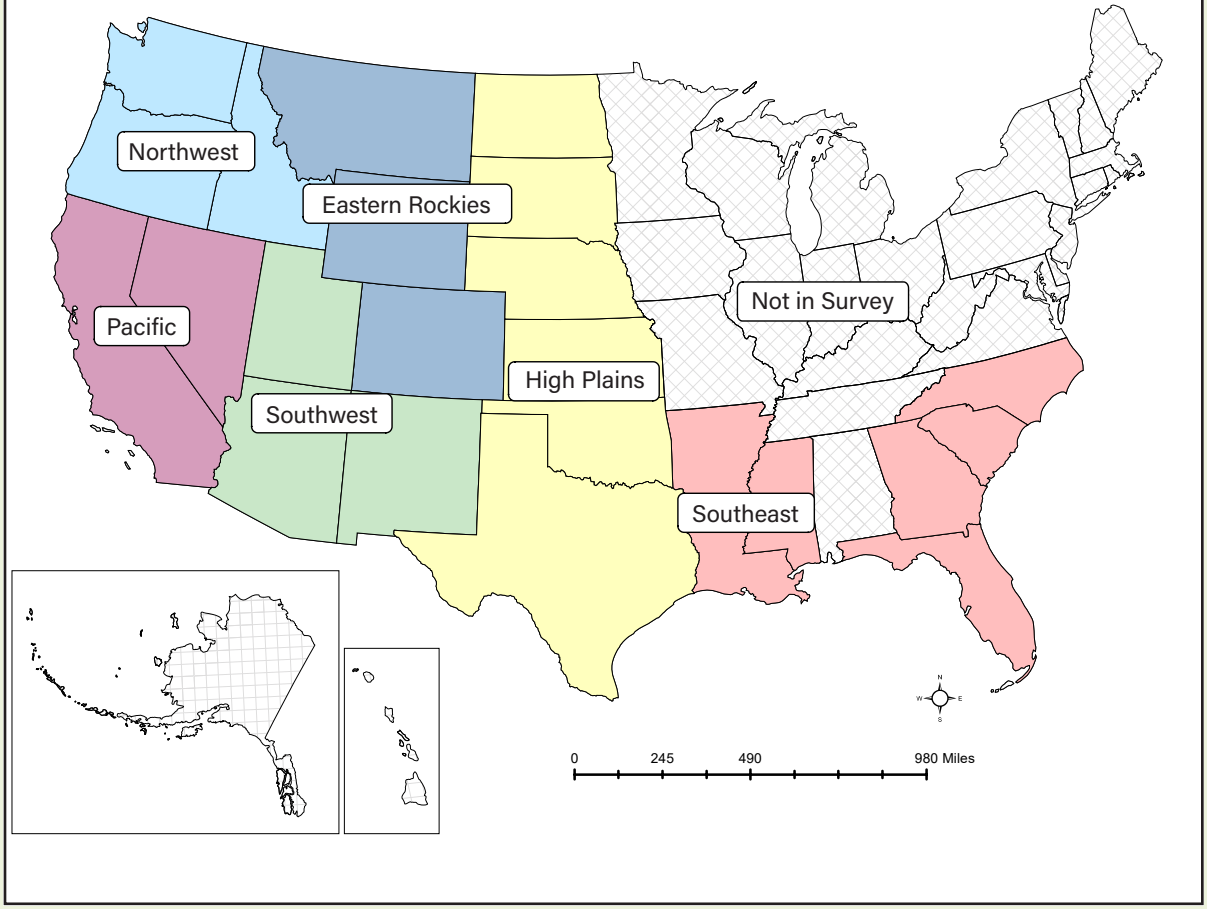
The SIO defined an irrigation organization as an entity that either delivers water to farms and ranches or influences on-farm groundwater use. Irrigation organizations are structured differently across the United States according to State water law and regional water resource development history. Examples of irrigation organizations that deliver water include irrigation districts, canal/ditch companies, acequias (communal irrigation ditches; see Hutchins (1928) for more information), and irrigation mutuals. Organizations that influence on-farm groundwater use include groundwater management districts, natural resource districts, and groundwater sustainability agencies (depending on State-enabling legislation). Some irrigation organizations engage in both on-farm groundwater management and water delivery.

The 2019 SIO was the first nationally representative Federal data collection of irrigation organizations since the U.S. Department of Commerce, Bureau of the Census conducted the 1978 Census of Irrigation Organizations (CIO). The 1978 CIO did not collect information on organizations that influence groundwater use because these types of organizations largely did not exist in 1978. Additionally, the 1978 CIO collected information on pass-through entities, which are organizations that store and deliver water to irrigation organizations but do not deliver water directly to farms and ranches. The 2019 SIO did not collect information on pass-through organizations. For a summary of selected survey findings and additional information on survey design, see USDA, NASS's Irrigation Organizations summary publication (USDA, NASS, 2020).



Box figure 1

Survey of Irrigation Organization Regions



Note: The cross-hatched shaded areas were not included in the 2019 Survey of Irrigation Organizations (SIO) because organizations that deliver water to farms or influence on-farm groundwater use are rare or nonexistent in those States. USDA, National Agricultural Statistics Service (NASS) SIO regions are as follows: Eastern Rockies (Colorado, Montana, and Wyoming); High Plains (Kansas, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas); Northwestern (Idaho, Oregon, and Washington), Pacific (California and Nevada), Southeastern (Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, and South Carolina) and Southwestern (Arizona, New Mexico, and Utah).

Source: USDA, Economic Research Service using data from USDA, NASS's Irrigation Organizations publication (USDA, NASS, 2020).

2019 Survey of Irrigation Organizations Organization Types

The 2019 SIO asked irrigation organizations that deliver water to farmers and other users to categorize themselves as: (1) Bureau of Indian Affairs (BIA) projects (operated by the U.S. Bureau of Indian Affairs), (2) irrigation districts (an entity given statutory authority to assess taxes and/or fees for water delivery), (3) incorporated mutuals (a legal entity owned by shareholders who use a ditch system), (4) unincorporated mutuals (an informal partnership among ditch users), or (5) other organization types (includes organizations primarily engaged in hydroelectric power or who otherwise do not consider themselves as one of the other organization types) (USDA, National Agricultural Statistics Service, 2019). BIA projects are irrigation organizations that are partially or wholly operated by the BIA and were originally developed to provide water for agricultural use to tribal communities. These organizations provide water to Tribes and non-Indian water users and manage over 50,000 irrigation structures (U.S. Government Accountability Office, 2015).

Although there is variation in terminology and legal structure, irrigation districts are generally self-governing quasi-public organizations, often with the power to issue bonds and levee fees or taxes on users to fund the construction, maintenance, and operation of conveyance infrastructure (Bretsen & Hill, 2006; Hutchins, 1931). In some cases, irrigation districts were created by or in concert with local, State, or Federal governments in conjunction with water projects or to finance and manage water conveyance infrastructure receiving water from those projects. Many irrigation districts contract for water supplies, but districts and their users may also own usage rights to water. Districts may also be empowered to use eminent domain to ensure the integrity of their canal and ditch conveyance infrastructure, which may cross numerous public and private lands (Kanazawa, 2023).

In contrast, mutuals are private organizations whose shareholders are their customers and may be incorporated or unincorporated (Bretsen & Hill, 2006; Hutchins, 1929). These organizations are often nonprofit and exempt from Federal and sometimes State taxes. Some mutuals are incorporated, which involves additional costs, but provides important benefits such as "the right to sell the stock of members for the nonpayment of assessments and the ability to make needed improvements in spite of the opposition of individuals or a minority group" (Hutchins, 1929). A primary difference between irrigation districts and mutuals is the financing of initial construction of irrigation infrastructure. Whereas historically irrigation districts often finance large irrigation works by issuing bonds, mutuals were limited to more localized funding through pooled resources or served to facilitate transfer of ownership to users after initial construction by private or public development projects (Hunt et al., 1976; Hutchins, 1929, 1931; Libecap, 2011). Unincorporated mutuals include communally owned ditch companies and traditional communal organizations, such as acequias (Crossland, 1990; Hutchins, 1928).

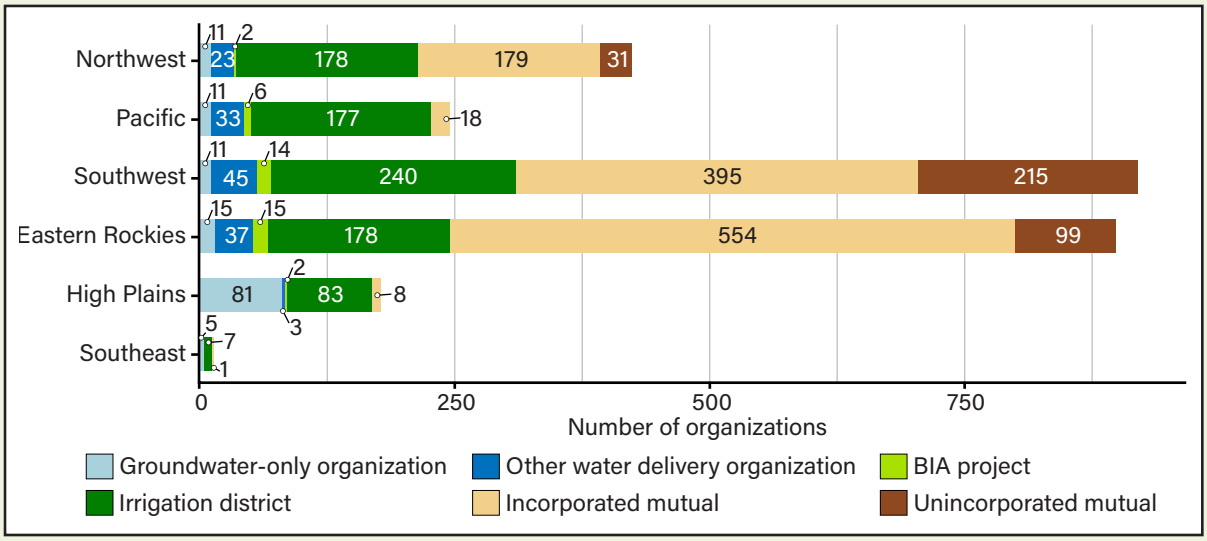
In contrast, mutuals are private organizations whose shareholders are their customers and may be incorporated or unincorporated (Bretsen & Hill, 2006; Hutchins, 1929). These organizations are often nonprofit and exempt from Federal and sometimes State taxes. Some mutuals are incorporated, which involves additional costs, but provides important benefits such as "the right to sell the stock of members for the nonpayment of assessments and the ability to make needed improvements in spite of the opposition of individuals or a minority group" (Hutchins, 1929). A primary difference between irrigation districts and mutuals is the financing of initial construction of irrigation infrastructure. Whereas historically irrigation districts often finance large irrigation works by issuing bonds, mutuals were limited to more localized funding through pooled resources or served to facilitate transfer of ownership to users after initial construction by private or public development projects (Hunt et al., 1976; Hutchins, 1929, 1931; Libecap,

2011). Unincorporated mutuals include communally owned ditch companies and traditional communal organizations, such as acequias (Crossland, 1990; Hutchins, 1928).

Regional differences in the types of irrigation organizations reflect the historical and environmental context of the region (box figure 2). BIA projects, irrigation districts, and mutuals are much more prevalent in the western regions of the United States, where irrigation organizations were primarily concerned with solving the problem of coordinating storage and conveyance of surface water (Kanazawa, 1998). The large number of incorporated and unincorporated mutuals in the Southwest and Eastern Rockies may reflect the smaller communities and economies during the development of irrigated agriculture in those regions. In contrast, storage and conveyance infrastructure was likely not economical in the High Plains, which receive more precipitation and have access to substantial groundwater resources that do not require collective action to extract. Instead, groundwater management organizations developed later to coordinate and manage groundwater resources for long term use (Allen & Smith, 2023; Dellapenna, 2012; Lueck, 1995).

Box figure 2

Regional differences in irrigation organization type, 2019



Note: The number of organizations includes those that delivered water at least once in 2015–19 or identified as groundwater organizations. There were 424 organizations in the Northwest, 245 in the Pacific, 920 in the Southwest, 898 in the Eastern Rockies, 177 in the High Plains, and 13 in the Southeast. Organization counts may differ from other USDA publications because groundwater-only organizations are delineated separately. Bureau of Indian Affairs (BIA) projects are wholly or partially owned by the BIA and manage irrigation water storage and conveyance infrastructure for delivering water to Native American and other irrigation water users. Irrigation districts are quasi-public institutions that usually receive most of their water from large State or Federal water projects. Incorporated mutuals and unincorporated mutuals are private organizations owned by the organization's constituent users. Other surface water organizations are composed of organizations that did not consider themselves one of the other organization types. Groundwater only organizations are organizations that are involved in groundwater management and did not indicate directly delivering water to users. Almost a quarter of irrigation water delivery organizations also indicated playing a role in groundwater management.

Source: USDA, Economic Research Service analysis using data from the USDA 2019 Survey of Irrigation Organizations.

Water Delivery Organization Types and Governance

The scale of different irrigation organization types was visible along several dimensions, such as acres served, farm size in terms of acres, total assets per acre served, and density of canals, ditches, and pipelines. Differences in scale can affect how decisions are made and what options are available for infrastructure investment, water management and efficiency, and conservation efforts. For example, about 15 percent of water that was delivered by these organizations was lost to the organization system during conveyance (USDA, NASS, 2020). These losses can be reduced by lining[6] and piping canals and ditches but require substantial capital investments that are not available to or make sense for all irrigation organizations (Hrozencik et al., 2024). Figure 1 summarizes the scale of different organization types along four dimensions, showing the mean of (1) acres served, (2) acres on each farm, (3) total assets per acre served, and (4) acres served per mile of conveyance. This figure illustrates that organizations more closely tied to public institutions, such as irrigation districts and Bureau of Indian Affairs (BIA) projects, tended to be not only larger in terms of acres but also had larger farms, more assets per acre, and serve more acres per mile of conveyance than other types of organizations. Although not shown, the same trend in area served and farm size that is shown in figure 1 also applied to the number of farms served.

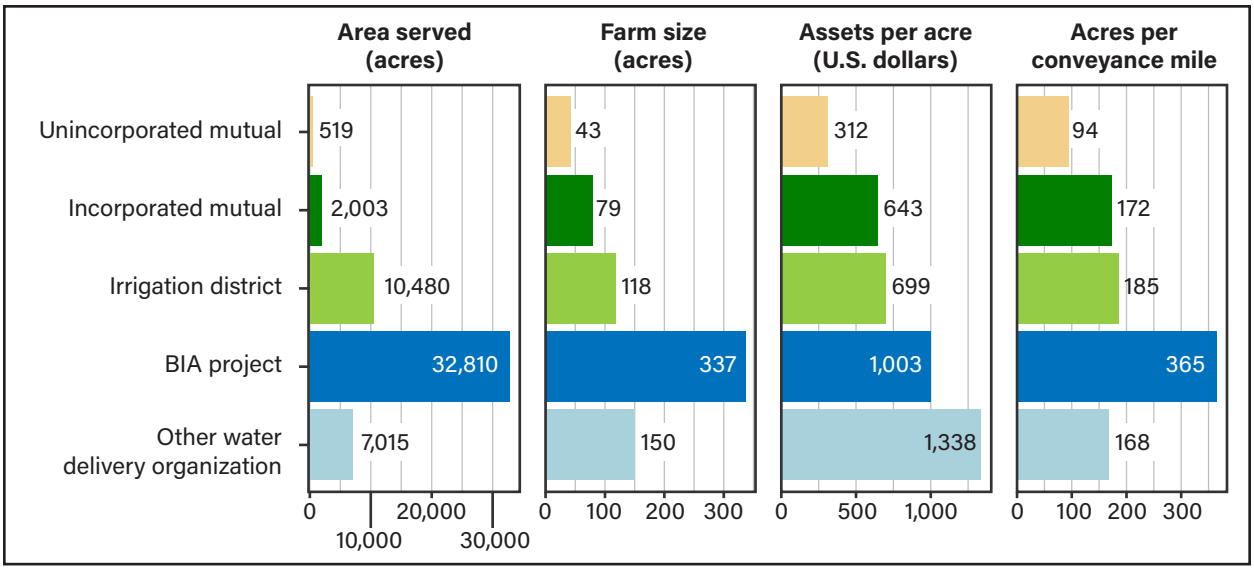
In some cases, larger public and quasi-public organizations, such as BIA projects and irrigation districts, developed in tandem with large-scale Federal and State water projects. State or Federal water projects may also require that an irrigation organization have a public or quasi-public status to contract water. In other cases, irrigation districts predate public water projects but were integral to their creation. This coupling can be seen in the importance of Federal and State water projects as a source of water for irrigation districts relative to other types of organizations. These differences are shown in figure 2, which compares the share of total water inflows comprised of Federal and State water projects versus other sources such as direct diversions from surface water bodies, among different types of organizations.

Organization types have differences in scale across area, farm size, assets per acre served, and conveyance infrastructure density

- Moving from unincorporated mutuals to incorporated mutuals to irrigation districts to BIA projects, average area served increases from 519 to 32,810 acres, average farm size increases from 43 to 337 acres, assets per acre increase from $312 to $1,003, and farmland irrigated per mile of conveyance increases from 94 to 365 acres.
- Unincorporated mutuals served 519 acres on average with 43 acres per farm and 94 acres per mile of conveyance. In comparison, irrigation districts served 10,480 acres on average with 118 acres per farm and 185 acres per mile of conveyance.
- Other water delivery organizations, which are more likely to be engaged in municipal water delivery and electricity generation, have $1,338 in assets per acre served on average, more than any other type of organization.

[6] Canals are typically lined with concrete, although other materials are sometimes used, including brick, stone, or specialized plastic sheeting.

Figure 1
Scale of acres, farm size, assets, and conveyance density by organization type, 2019



BIA = Bureau of Indian Affairs.

Note: Values are means for each category. Values are truncated at the 10th and 90th percentile to reduce the influence of outliers. "Area served" is acres that could have been irrigated during 2015–19. "Farm size" is acres served divided by farms served. "Assets per acre" is total assets divided by acres served. "Acres per conveyance mile" is acres served divided by total miles of main and lateral canals, ditches, and pipes. Organizations classified as groundwater only organizations and organizations without any conveyance infrastructure were excluded because they do not deliver water to farms. Values may differ from other USDA publications because some organizations were excluded and outlier values were truncated.

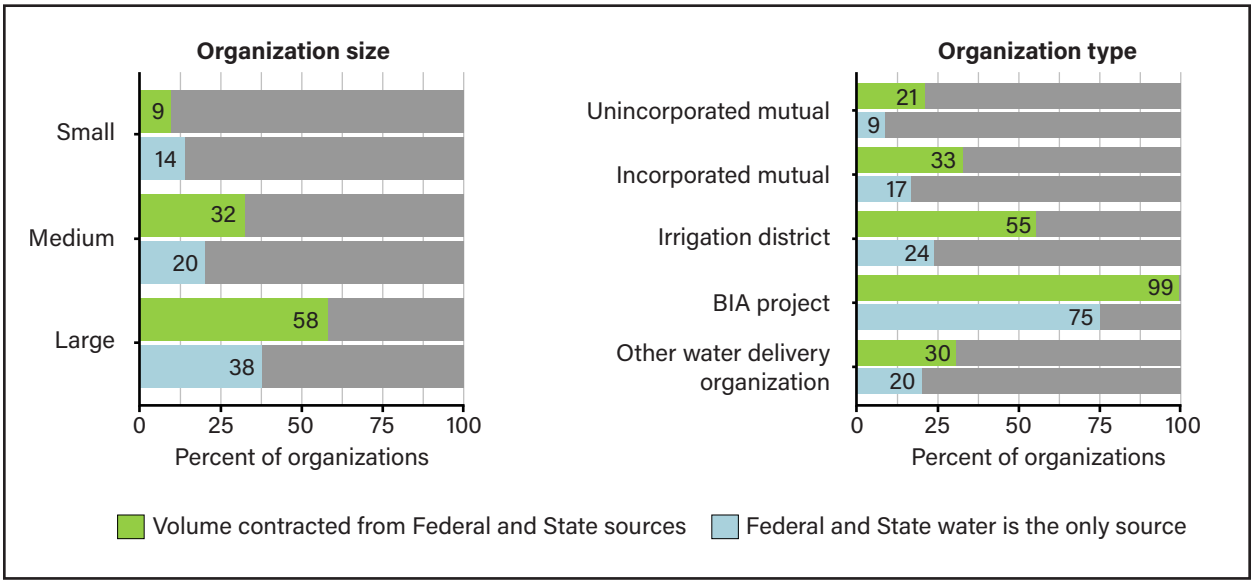
Source: USDA, Economic Research Service analysis using data from the USDA 2019 Survey of Irrigation Organizations.

Larger and more public irrigation organizations receive more of their water from Federal and State water sources

- The percent of water sourced from Federal and State sources increased as irrigation organization size increased, with 9 percent of water inflows for small organizations to 58 percent of water inflows to large organizations.
- Federal and State water plays an increasingly important role as organization scale increases. Federal and State water was the only source of water for about 9 percent of unincorporated mutuals compared with 24 percent of irrigation districts.
- BIA projects were most tightly connected with Federal and State water projects, which accounted for 99 percent of water inflows. Federal and State water projects were the only source of water for 75 percent of BIA projects.

Figure 2

Water sourced from Federal and State water projects by organization size and organization type (percent of total water supplies), 2019



BIA = Bureau of Indian Affairs.

Note: "Volume contracted from Federal and State sources" is the total volume of water from all irrigation organizations sourced from Federal and State water projects as a percent of total water inflows from all sources for each organization group. "Federal and State water is the major source" is the percent of organizations for which Federal and State water sources was the largest of any source. "Federal and State water is the only source" is the percent of organizations that only received water from Federal or State water projects. Small, medium, and large organizations are organizations that served less than 1,000 acres, 1,000 to 10,000 acres, and more than 10,000 acres, respectively. Groundwater only organizations were not included because they did not deliver water and, therefore, did not source water.

Source: USDA, Economic Research Service analysis using data from the USDA 2019 Survey of Irrigation Organizations.

Irrigation Organization Membership Participation and Voting

Irrigation organizations may involve their constituent members or customers in key decisions through several mechanisms, one of which is voting either directly on issues or indirectly through a board of representatives. Some mechanisms are more common in specific types of irrigation organizations, in part due to legislative requirements for incorporated mutuals, irrigation districts, and groundwater organizations. In the 2019 SIO, between 67 and 100 percent of organizations either used direct voting on issues or had a board of representatives. Figure 3 shows the percentage of each organization type allowing direct voting, having a board of representatives, or having neither.

Voting in irrigation organizations can also vary in how votes are counted. The 2019 SIO asked irrigation organizations with an elected board of representatives whether votes were allocated as one vote per user; proportional to land, water, or share; or some other method.[7] Where farm sizes in an irrigation organization system vary substantially, a per-user voting system can weigh decisions toward the interests of smaller farms, while a per-acre or per-share system can weigh decisions toward the interests of larger operations. These differences in vote allocation for elected boards of representatives by organization type are shown in figure 4.

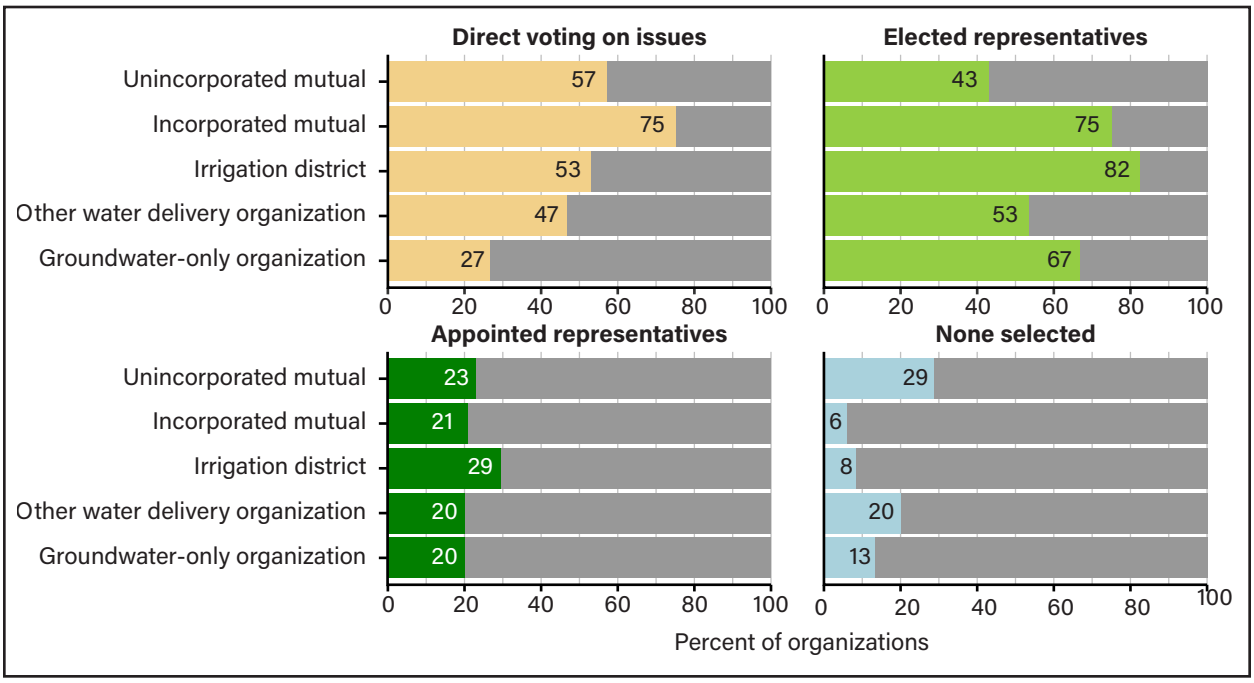
Some irrigation organizations may be nonprofit organizations, which can be motivated by financial aspects, access to grants or public funding, or legal requirements in some jurisdictions.

Voting on direct issues or for elected boards of representatives is common among irrigation organizations of all types, and most prevalent in incorporated mutuals

- About 75 percent of incorporated mutuals and 57 percent of unincorporated mutuals had direct voting on key issues at regular meetings compared to about half of other types of water delivery organizations.
- At least two-thirds of most types of organizations had an elected board of representatives compared to 43 percent of unincorporated mutuals and 53 percent of other water delivery organizations.
- Between 20 and 29 percent of organizations of all types had an appointed board of representatives.
- Only 6 percent of incorporated mutuals and 8 percent of irrigation districts did not indicate having direct voting or a board of representatives.

[7] The specific language of this response was, "On a proportional basis (e.g., one vote per share/acre/acre-foot)."

Figure 3
Frequency of voting mechanisms by organization type, 2019



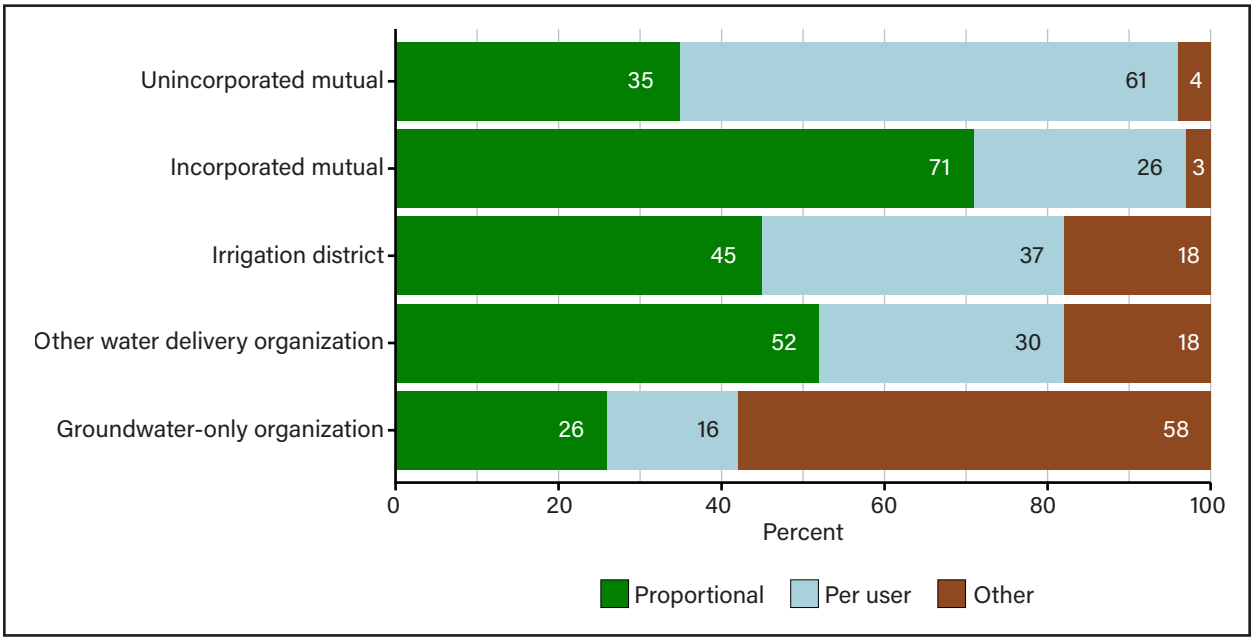
Note: "Direct voting on issues" is users voting on key issues at regular meetings. "Appointed representatives" is a board of representatives with appointed members. "Elected representatives" is a board of representatives that is elected by irrigation organization members. "None selected" is neither direct voting, appointed representatives, or elected representatives. Bureau of Indian Affairs projects were withheld to avoid disclosing data for individual operations.

Source: USDA, Economic Research Service analysis using data from the USDA 2019 Survey of Irrigation Organizations.

Methods of counting votes for elected boards of representatives varies substantially among different types of irrigation organizations

- About 71 percent of incorporated mutuals allocated votes for elected boards of representatives according to land, water, or shares, more than any other type of organization.
- Boards of representatives were elected using one vote per user or account in 61 percent of unincorporated mutuals, while 35 percent counted votes proportional to land, water, or share.
- The method of allocating votes for boards of representatives was split among irrigation districts, where 45 percent allocated votes according to land, water, or user shares; 37 percent allocated one vote per user or account; and 18 percent allocated votes by some other method.
- The majority (58 percent) of groundwater-only organizations use a method of counting votes other than proportional or per user voting.

Figure 4
Percent of allocation of votes among organizations with elected boards of representatives by organization type, 2019



Note: "Proportional" is vote allocation by acreage, acre-foot, or share. "Per user" is one vote per user or account. "Other" is a vote allocation other than proportional or per user. Organizations could only choose one option. Bureau of Indian Affairs projects were withheld to avoid disclosing data for individual operations. Totals may not sum to 100 due to rounding.

Source: USDA, Economic Research Service analysis using data from the USDA 2019 Survey of Irrigation Organizations.

Irrigation Organization Assets and Assessments

Different types of irrigation organizations have different asset structures that reflect the context of their creation, scale of operation, and available avenues for raising funds. Irrigation organization assets include the canals, ditches, and pipelines used to deliver water to users; any water storage facilities; land, buildings, and equipment owned by the organization; and financial capital. The 2019 SIO asked irrigation organizations to report their assets across four categories: financial reserves, infrastructure, land and buildings, and other assets. Asset allocations within these categories illustrate differences in funding methods and operational scale between different types of irrigation organizations. Irrigation districts were generally larger and more connected with State and Federal water projects and empowered to tax and issue bonds. These districts also had significantly more assets in financial reserves than other types of organizations (table 2). In contrast, unincorporated mutuals, which are typically smaller and historically more closely tied to local communities, had a greater proportion of assets in land and buildings (figure 5).

An important function of irrigation water delivery organizations is maintaining irrigation storage and delivery infrastructure and managing contracted water and rights to use water (for information on irrigation organization infrastructure, see Hrozencik et al. (2021)). A primary way that irrigation organizations raise funds for these activities is by charging users some combination of a per-acre or per-user assessment and a volumetric price per acre-foot for water delivered to users. By definition, groundwater only organizations don't deliver water but they may instead charge a volumetric price per acre-foot of water pumped if legally allowed.[8] Irrigation organizations may also earn revenue through other means, including providing water to nonagricultural users, generating electricity, or other methods. Some organizations may also charge special assess-

[8] See Hrozencik et al. (2025) for details on water measuring and pricing by irrigation organizations.

ments for specific costs when needed, which may not be reflected in data from the 2019 SIO. Figure 6 shows the percent of organizations that reported earning revenue by assessment or volumetric pricing for delivered water. These prices varied substantially, with prices being higher on average among irrigation districts. These differences were likely due to several factors possibly related to location that may have affected and continue to affect farm productivity, development costs, and the cost of water, as well as organizational costs that may have resulted from being more closely tied to State and Federal water projects or other factors.

Assets are larger in some organization types and in organizations that serve a larger area

- About 30 and 33 percent, respectively, of small and medium unincorporated mutuals had assets above $150 per acre served, less than any other type of organization of any size.
- In all cases, the percentage of organizations with assets greater than $150 per acre served increases as we move from unincorporated mutuals to incorporated mutuals to irrigation districts.
- About 80 percent of large irrigation districts and 67 percent of large BIA projects had assets greater than $150 per acre served, more than any other group of irrigation organizations.

Table 2
Percent of organizations with at least $150 per acre in assets, by organization type and size, 2019

	Small	Medium	Large
Unincorporated mutual (percent)	30	33	--
Incorporated mutual (percent)	55	36	50
Irrigation district (percent)	40	57	80
Bureau of Indian Affairs project (percent)	D	D	67
Other water delivery organization (percent)	50	67	D

D = data withheld to avoid disclosing data for individual operations. -- = groups with no organizations.

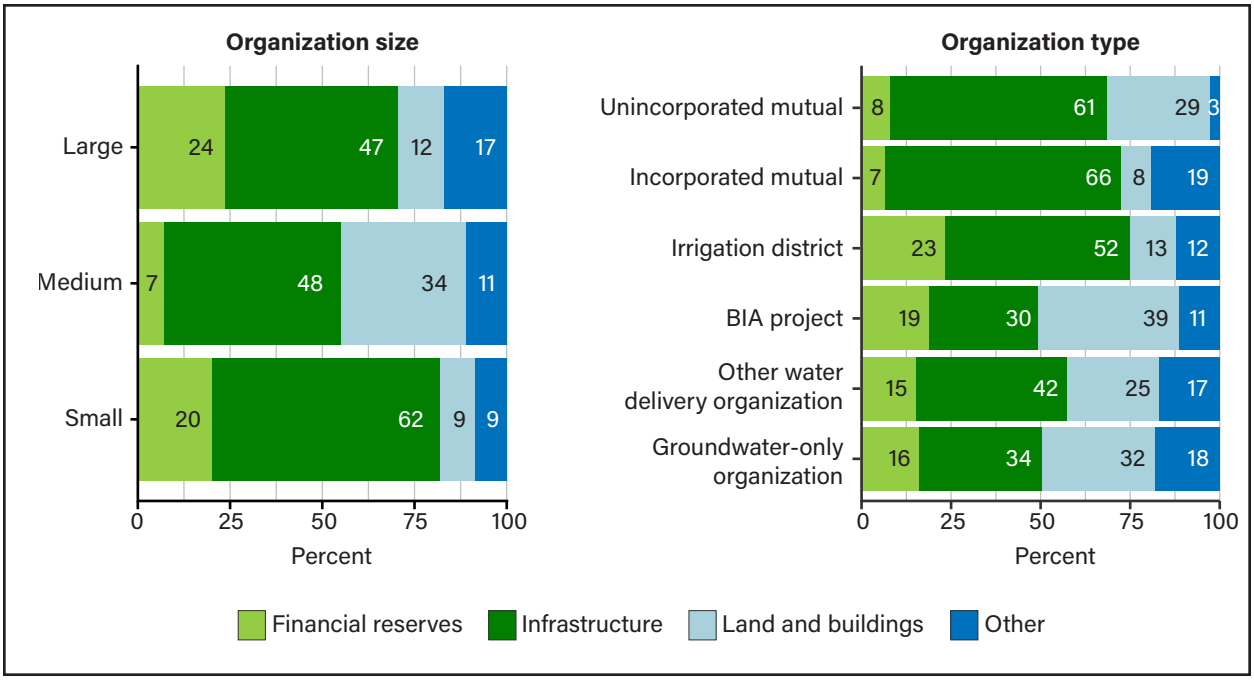
Note: Values are the percent of organizations with assets per acre exceeding $150 per acre, which is about the median response among all organizations that reported assets. "Assets per acre" are total assets divided by acres served by the organization. Small organizations serve less than 1,000 acres, medium organizations serve between 1,000 and 10,000 acres, and large organizations serve more than 10,000 acres. Groundwater only organizations are not included because they did not provide water to farmland and as a result had no size definition.

Source: USDA, Economic Research Service analysis using data from the USDA 2019 Survey of Irrigation Organizations.

Smaller irrigation organizations and incorporated and unincorporated mutuals concentrate assets in infrastructure and land and building

- About 23 percent of irrigation district assets were financial reserves, whereas other types of organizations had between 7 and 19 percent of assets in financial reserves.
- Infrastructure comprised about 62 percent of assets among small organizations, 48 percent of assets among medium organizations, and 47 percent of assets among large organizations.
- Infrastructure comprised about 61 percent of unincorporated mutual organization assets, 66 percent of incorporated mutual organization assets, and 52 percent of irrigation district assets. Other types of organizations averaged between 30 and 42 percent.
- Land and buildings of medium-sized organizations comprised 34 percent of assets, more than 12 percent of large-sized organizations and 9 percent of small-sized organizations.

Figure 5
Organization asset composition percent by organization size and type, 2019



BIA = Bureau of Indian Affairs.

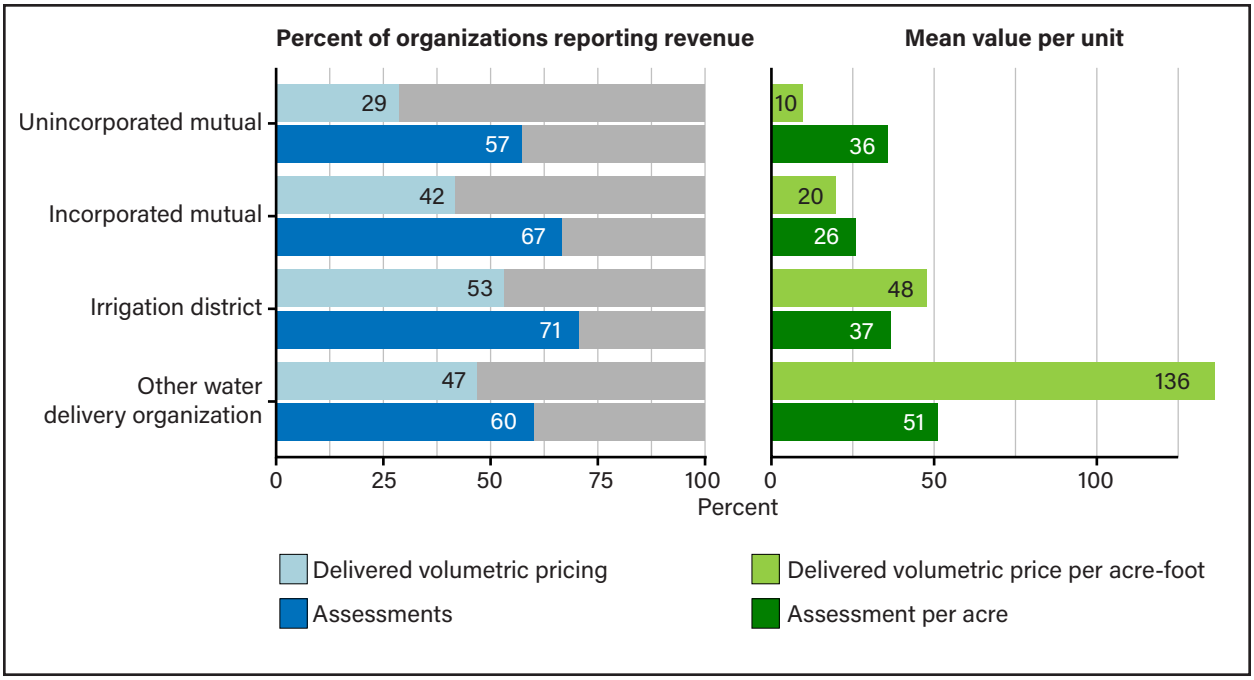
Note: Small organizations serve less than 1,000 acres, medium organizations serve between 1,000 and 10,000 acres, and large organizations serve greater than 10,000 acres. Values are the percent of total assets by each asset type for organization size or organization type as a whole. Groundwater only organizations did not report acres served and are not included in organization size statistics. Totals may not sum to 100 due to rounding.

Source: USDA, Economic Research Service analysis using data from the USDA 2019 Survey of Irrigation Organizations.

Most organizations levy an assessment on users, but per acre assessments in different organization types are similar

- Assessments were levied on users by 57 percent of unincorporated mutuals and 71 percent of irrigation districts while 29 percent of unincorporated mutuals and 53 percent of irrigation districts had volumetric pricing for delivered water.
- The mean volumetric price was $48 per acre-foot for irrigation districts, $20 per acre-foot for incorporated mutuals, and $10 per acre-foot for unincorporated mutuals.
- In contrast to volumetric pricing differences, per acre assessments are relatively similar between different organization types. Incorporated mutuals charge the lowest mean per acre assessment at $26, while other water delivery organizations charge the highest at $51 per acre.
- Other water delivery organizations include more organizations that provide municipal water or electricity. These organizations charge $136 per acre-foot on average.

Figure 6
Use of pricing and water fee assessment methods by organization type, 2019



Note: Delivered volumetric price per acre-foot and Assessment per acre values were truncated at the 10th and 90th percentile to reduce the influence of outliers. "Percent of organizations reporting revenue" is the percent of organizations that report revenue from either an assessment or volumetric price. "Mean value per unit" is the mean value of volumetric pricing for delivered water per acre-foot and mean assessment per acre reported. "Delivered volumetric pricing" is revenue from volumetric pricing for water delivered to the farm or ranch. "Assessments" is an assessment or tax charged to users. "Delivered volumetric price per acre-foot" is the mean volumetric price of delivered water per acre-foot for reporting organizations. "Assessment per acre" is mean user assessment or tax per acre charged to users for reporting organizations. Bureau of Indian Affairs projects were withheld to avoid disclosing data for individual operations. Groundwater only organizations are not included because they do not deliver water to the farm gate. About 40 percent of groundwater only organizations levied an assessment, with a mean of $4 per acre.

Source: USDA, Economic Research Service analysis using data from the USDA 2019 Survey of Irrigation Organizations.

Conclusion

This report draws on data from the 2019 Survey of Irrigation Organizations (SIO) to illustrate how different types of irrigation organizations differ in scale, water source, approaches to voting, and assets and revenues. Irrigation water delivery organizations were created to solve the task of getting water to farms, and these differences suggest systematic differences in the approach to managing that task.

At the smallest scale, unincorporated mutual organizations served fewer acres and had fewer, smaller-sized farms, reflecting the more localized and smaller-scale water supply problems they solved. These types of organizations included community-based organizations that were not legally incorporated as a for-profit or nonprofit organization. Only a small share of unincorporated mutuals received water from State or Federal water projects, and that water comprised a small amount of an organization's total water supply, on average. More unincorporated mutuals reported that members directly voted on issues than had an elected board of representatives, something that was not true of any other type of irrigation organization. Unincorporated mutual organizations also had a greater share of assets in land and buildings than other types of irrigation organizations and had the lowest average price per acre-foot or assessment per acre.

Moving up in scale, incorporated mutuals, on average, were an order of magnitude larger than unincorporated mutuals in terms of acres served but still smaller than irrigation districts and Bureau of Indian Affairs (BIA) projects. Incorporated mutuals are similar to unincorporated mutuals in that they are less connected to State and Federal water projects and have similar asset structures that differ from other organization types. However, like irrigation districts, incorporated mutuals differ from unincorporated mutuals in that a substantial majority of organizations use direct voting. As largely public or quasi-public institutions often existing within large-scale State and Federal irrigation water supply solutions, irrigation districts were an order of magnitude larger than incorporated mutuals along several dimensions. The survey found that irrigation districts served more acres and had larger farms in terms of acres served but had similar acres per mile of conveyance to incorporated mutuals. Irrigation districts, being empowered to levy taxes and issue bonds, also have a larger share of assets in financial reserves than other types of organizations. The survey results show they also charged higher prices per acre-foot for water and assessed higher values per acre than other organization types.

Other types of water delivery organizations in the survey included BIA projects and other water delivery organizations. The results from these organizations did not correspond to other types of water delivery organizations because BIA projects are themselves Federal organizations, or because the other water delivery organizations group included a wide variety of organizations that were engaged in delivering water to municipal users, electricity generation, or other nonagricultural activities. BIA projects tended to have large service areas and substantial assets and, being part of Federal water projects, received almost no water from other sources.

The remaining category of irrigation organization was groundwater only organizations. While relatively few groundwater only organizations had direct voting, many had an elected board of representatives. More than half reported allocating votes by some other method than proportionally or per user. As these organizations did not convey water to users, it was no surprise that infrastructure comprised a smaller share of their assets than any other type of organization.

These differences between organization types are important because they play a role in the capacity of these organizations to respond to water shortages and drought. With larger farms and substantial involvement in Federal water programs, BIA projects have the capacity to leverage substantial resources made available by the Federal government to respond to drought. Irrigation districts, as recipients of substantial water from State and Federal water projects, may also be able to provide greater water security to their members. Irrigation districts can also make use of higher capitalization and the ability to levy taxes and issue bonds to undertake large scale infrastructure projects and improvements that can improve drought response and mitigate impacts. Mutual organizations may be able to respond quickly to drought conditions and are small enough to make use of direct voting to make decisions. Unincorporated mutuals can utilize community-based structures to respond to local conditions and act in the best interest of their communities.

References

Allen, J. J., & Smith, S. M. (2023). Market-oriented solutions for groundwater commons through collective-action. *Environmental Research Letters, 18*(4), 045006.

Ayres, A. B., Meng, K. C., & Plantinga, A. J. (2021). Do environmental markets improve on open access? Evidence from California groundwater rights. *Journal of Political Economy, 129*(10), 2817–2860.

Blomquist, W. (1988). Getting out of the commons trap: Variables, process, and results in four groundwater basins. *Social Science Perspectives Journal, 2*(4), 16–44.

Bretsen, S. N., & Hill, P. J. (2006). Irrigation institutions in the American west. *UCLA Journal of Environmental Law & Policy, 25*(2), 283–331.

Coman, K. (2011). Some unsettled problems of irrigation (1911). *American Economic Review, 101*(1), 36–48. https://doi.org/10.1257/aer.101.1.36.

Crossland, C. B. (1990). Acequia rights in law and tradition. *Journal of the Southwest*, 278–287.

Dellapenna, J. (2012). A primer on groundwater law. *Idaho Law Review, 49*, 265–316.

Dettinger, M., & Anderson, M. (2015). Storage in California's reservoirs and snowpack in this time of drought. *San Francisco Estuary and Watershed Science, 13*.

Edwards, E. C. (2016). What lies beneath? Aquifer heterogeneity and the economics of groundwater management. *Journal of the Association of Environmental and Resource Economists, 3*(2), 453–491.

Hanemann, M. (2014). Property rights and sustainable irrigation—A developed world perspective. *Agricultural Water Management, 145*, 5–22.

Hrozencik, R. A., Gardner, G., Potter, N. A., & Wallander, S. (2023). *Irrigation organizations: Groundwater management* (Report No. EB-34). U.S. Department of Agriculture, Economic Research Service.

Hrozencik, R. A., Potter, N. A., & Wallander, S. (2024). The cost-effectiveness of irrigation canal lining and piping in the western United States. In G. Libecap & A. Dinar (Eds.), *American agriculture, water resources, and climate change*. University of Chicago Press.

Hrozencik, R. A., Potter, N. A., & Wallander, S. (2025). *Irrigation organizations: Water measurement and pricing* (Report No. EB-40). U.S. Department of Agriculture, Economic Research Service.

Hrozencik, R. A., Wallander, S., & Aillery, M. (2021). *Irrigation organizations: Water storage and delivery infrastructure* (Report No. EB-32). U.S. Department of Agriculture, Economic Research Service.

Hunt, R. C., Hunt, E., Ahmed, G. M., Bennett, J. W., Cleek, R. K., Coy, P. E. B., Glick, T. F., Lewis, R. E., MacLachlan, B. B., Mitchell, W. P., Partridge, W. L., Price, B. J., Roder, W., Steensberg, A., Wade, R., & Wellmann, I. (1976). Canal irrigation and local social organization. *Current Anthropology, 17*(3), 389–411.

Hutchins, W. (1928). The community acequia: Its origin and development. *The Southwestern Historical Quarterly, 31*, 261–284.

Hutchins, W. (1929). *Mutual irrigation companies* (Report No. TB-82). U.S. Department of Agriculture.

Hutchins, W. (1931). *Irrigation districts: Their organization operation and financing* (Report No. TB-254). U.S. Department of Agriculture.

Kanazawa, M. T. (1998). Efficiency in western water law: The development of the California doctrine, 1850–1911. *The Journal of Legal Studies, 27*(1), 159–184. https://doi.org/10.1086/468017.

Kanazawa, M. T. (2023). Politics and eminent domain: Evidence from the 1879 California constitution. *Explorations in Economic History, 90*, 101546.

Lehner, F., Coats, S., Stocker, T. F., Pendergrass, A. G., Sanderson, B. M., Raible, C. C., & Smerdon, J. E. (2017). Projected drought risk in 1.5° C and 2° C warmer climates. *Geophysical Research Letters, 44*(14), 7419–7428.

Leonard, B., & Libecap, G. D. (2019). Collective action by contract: Prior appropriation and the development of irrigation in the western United States. *The Journal of Law and Economics, 62*(1), 67–115.

Libecap, G. D. (2011). Institutional path dependence in climate adaptation: Coman's 'Some unsettled problems of irrigation'. *American Economic Review, 101*(1), 64–80.

Liu, J., Yang, H., Gosling, S. N., Kummu, M., Flörke, M., Pfister, S., Hanasaki, N., Wada, Y., Zhang, X., Zheng, C., Alcamo, J., & Oki, T. (2017). Water scarcity assessments in the past, present, and future. *Earth's Future, 5*(6), 545–559.

Lueck, D. (1995). The rule of first possession and the design of the law. *The Journal of Law and Economics, 38*(2), 393–436. https://doi.org/10.1086/467337.

Moss, T., & Newig, J. (2010). Multilevel water governance and problems of scale: Setting the stage for a broader debate. *Environmental Management, 46*, 1–6.

Nunn, S. C. (1985). The political economy of institutional change: A distribution criterion for acceptance of groundwater rules. *Natural Resources Journal, 25*(4), 867–892.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.

Ostrom, E. (2011). Reflections on 'Some unsettled problems of irrigation.' *American Economic Review, 101*(1), 49–63.

Ostrom, E., & Gardner, R. (1993). Coping with asymmetries in the commons: Self-governing irrigation systems can work. *Journal of Economic Perspectives, 7*(4), 93–112.

Potter, N. A., Hrozencik, R. A., & Wallander, S. (2023). *Irrigation organizations: Water inflows and outflows* (Report No. EB-36). U.S. Deparment of Agriculture, Economic Research Service.

Provencher, B., & Burt, O. (1993). The externalities associated with the common property exploitation of groundwater. *Journal of Environmental Economics and Management, 24*(2), 139–158.

Schaible, G., & Aillery, M. (2017). Challenges for U.S. irrigated agriculture in the face of emerging demands and climate change. In J. R. Ziolkowska & J. M. Peterson (Eds.), *Competition for water resources* (pp. 44–79). Elsevier.

Seabright, P. (1993). Managing local commons: theoretical issues in incentive design. *Journal of Economic Perspectives, 7*(4), 113–134.

Simmons, M. (1972). Spanish irrigation practices in New Mexico. *New Mexico Historical Review, 47*(2), 4.

U.S. Department of Agriculture, National Agricultural Statistics Service. (2019). *Survey of irrigation organizations*.

U.S. Department of Agriculture, National Agricultural Statistics Service. (2020). *Irrigation organizations 2019 summary*.

U.S. Government Accountability Office. (2015). *Indian irrigation projects: Deferred maintenance and financial sustainability issues remain unsolved* (Report No. GAO-15-453T).

Wallander, S., Hrozencik, R. A., & Aillery, M. (2022). *Irrigation organizations: Drought planning and response* (Report No. EB-33). U.S. Department of Agriculture, Economic Research Service.

Wescoat, J. L. (2023). Institutional levels of water management in the Colorado River basin region: A macro-historical geographic review. *Frontiers in Water, 4*.

Wohlers, T., Mason, A., Wood, J., & Schmaltz, E. (2014). Tragedy of the commons meets the anti-commons: Water management and conflict on the southern plains of the United States. *Journal of Environmental Assessment Policy and Management, 16*(01), 1450005.

This Economic Brief is the sixth in a series of briefs based on the USDA 2019 Survey of Irrigation Organizations:

Irrigation Organizations:
Water Storage and Delivery Infrastructure

Irrigation Organizations:
Drought Planning and Response

Irrigation Organizations:
Groundwater Management

Irrigation Organizations:
Water Inflows and Outflows

Irrigation Organizations:
Water Measurement and Pricing

Irrigation Organizations:
Organization Types and Governance

The mission of USDA's Economic Research Service is to anticipate trends and emerging issues in agriculture, food, the environment, and rural America and to conduct high-quality, objective economic research to inform and enhance public and private decision making. ERS shapes its research programs and products to serve those who routinely make or influence public policy and program and decisions.

Follow us on X
@USDA_ERS
www.ers.usda.gov