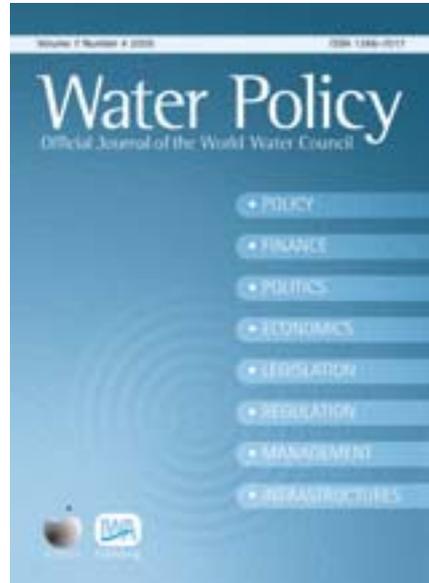


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Resolving water conflicts in the American West

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Abstract

The American West is defined first and foremost by aridity, scarcity, and variability of water resources. In response to this geographic imperative, the region has evolved a robust menu of legal, institutional, and community-based approaches to managing water and conflicts at local, state, and national levels. While far from perfect, this framework may offer lessons to other regions throughout the world that are increasingly faced with water conflicts due to scarcity and variability of water resources. The resulting menu of approaches reflects an adaptive, collaborative, and nested system of governing water resources.

Keywords: Methods to manage water and resolve water conflicts; Water scarcity

1. Introduction

The American West includes all or part of 18 states (including Alaska, but not Hawaii) lying west of the 100th meridian, a longitudinal line bisecting North Dakota in the north and Texas in the south. This region is defined first and foremost by aridity, scarcity, and variability of water resources. In response to this geographic imperative, the region has invented a robust menu of legal, institutional, and community-based approaches to managing water and conflicts at local, state, and national levels. While far from perfect, this framework may offer lessons to other regions throughout the world that are increasingly faced with water conflicts due to scarcity and variability of water resources.

We are not suggesting that the American West has designed a fail-safe model for managing water and resolving water conflicts. Rather, the region's experiences over the past 150 years or more provide a compelling story of active adaptation – how the ideas and institutions for managing water and conflict in the face of aridity, scarcity, and variability have evolved over time as social, economic, and environmental forces have changed. We hope this story of sometimes deliberate, but often fortuitous, adjustment informs and invigorates efforts to design adaptive systems of water governance in other

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regions of the world. While general themes are often modulated by specific circumstances, we likewise hope to harvest lessons from other regions that might have some applicability to the American West.

2. The American West

The origin and resolution of water conflicts anywhere in the world are context dependent; they depend on the mix of social, economic, cultural, environmental, and legal and institutional variables defining different countries, regions, and communities. Given these contextual differences, why take the time to learn how the American West prevents and resolves conflicts over water?

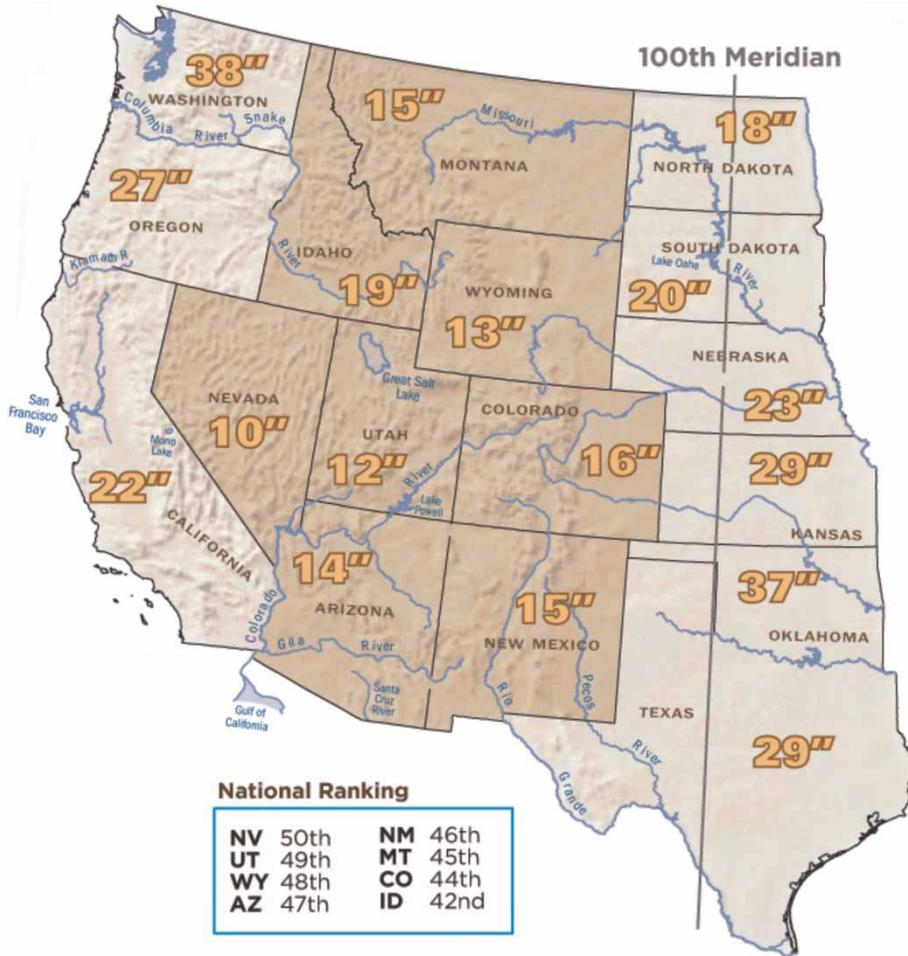
First, one of the features that most defines the American West is water – or more accurately, the lack thereof (Stegner, 1969). The area west of the 100th meridian – except for the thin coastal region in the Pacific Northwest – receives very little precipitation (Figure 1). In the Rocky Mountain region, seven of the eight states rank as the driest states in the nation. Ironically, the West also contains the headwaters of the continent's major river systems – including the Columbia, Missouri/Mississippi, Rio Grande, and Colorado rivers, as well as the driest parts of the country – the Mojave, Sonoran, Great Basin, and Chihuahuan deserts. Water has always been a vital, scarce, and variable resource in the West. It is a source of both conflict and community, and the region has developed a robust menu of ideas, institutions, and practices over 150 years to manage water and resolve water conflicts. We hope this story informs and invigorates other efforts to design adaptive institutions and policies in similarly arid regions.

The second reason to study the American West is that water and land management occurs in a complicated patchwork of public and private jurisdictions. Within this complex intergovernmental system, the authority and responsibility for managing land, water, wildlife, and other natural resources in the region are extremely fragmented. The allocation of water is largely the responsibility of state governments, while the protection of water quality falls on the federal government (or delegated federal programs). The federal government is responsible for managing nearly 50% of the land in the American West (Figure 2), but state and local governments control much of the permitting and zoning within their jurisdictions. State governments manage wildlife, except for endangered species regulated by the federal government. Add to this web the sovereign authority exercised by Indian Nations over natural resources management within their jurisdictions and it is easy to understand why there are so many conflicts over water and other natural resources. This complex intergovernmental system has compelled the West to invent a number of innovative approaches to manage water and resolve conflict, and may offer some additional lessons that might be applicable to other regions characterized by interjurisdictional complexity.

The third and final reason to examine the American West is that it may be instructive for other regions facing the challenges of urban water supply. The West is home to several of the fastest-growing communities and states in the United States. As illustrated by Figures 3 and 4, employment, population, and personal income in the West have been growing more rapidly than in non-West areas during the past four decades (Rasker, 2012). By 2030, the region is expected to be home to 25% of all Americans, up from about 0% in 1830 and 9% in 1930.

In *West is Best*, the authors suggest that one of the primary reasons why the West has outperformed the economy of the rest of the nation is the region's national parks, monuments, wilderness areas, and other public lands (Rasker, 2012). The research shows that higher-wage service industries – such as high tech

Average Annual Precipitation (in inches)



Source: Adapted by Center for Natural Resources & Environmental Policy from USGS

Fig. 1. Average annual precipitation, western United States (United States Geological Survey).

and health care – are leading the West’s job growth and diversifying the economy. Traditional livelihoods – such as farming, ranching, mining, and timber harvesting – are being supplemented with ‘footloose entrepreneurs’ who choose to work where they can enjoy outdoor recreation and natural landscapes.

With more people and economic activities, many of the region’s landscapes are under increasing pressure. Figure 5 illustrates that five major ‘megaregions’ are emerging in the American West (Cascadia, Northern California, Southern California, Front Range, and Arizona Sun Corridor). Each of these megaregions, no matter how large the metropolitan footprint, includes and relies on resources the cities cannot live without – water, food, energy, wood products, open space, wildlife corridors, and recreational opportunities – sometimes referred to as ecosystem services. Figure 6 illustrates potential

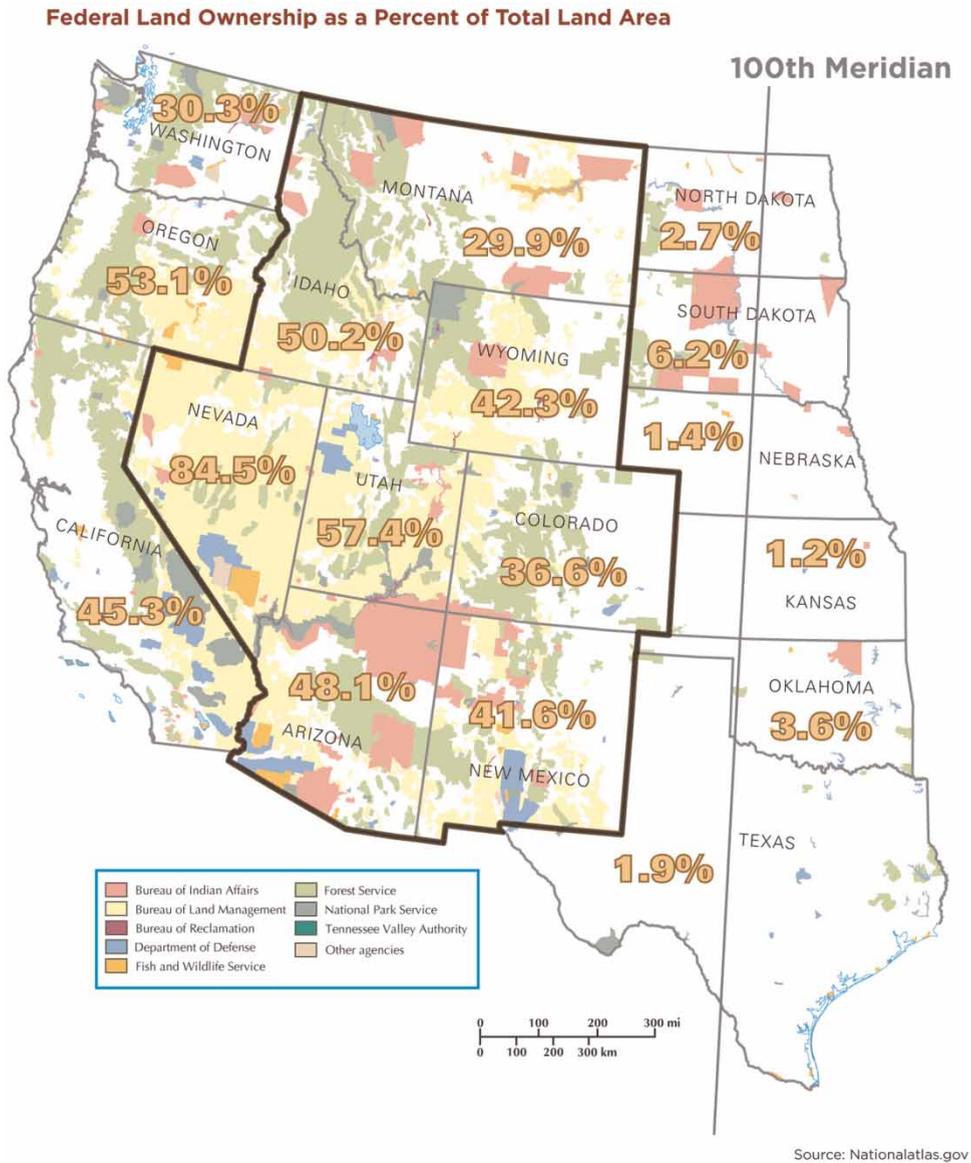


Fig. 2. Federal land ownership, western United States.

water supply conflicts in the region, highlighting the tension between population growth and endangered species protection.

3. Foundations of water conflict resolution

The foundations of water conflict resolution in the American West emerge from the history of water use and development, beginning with the region’s indigenous people. This section highlights the

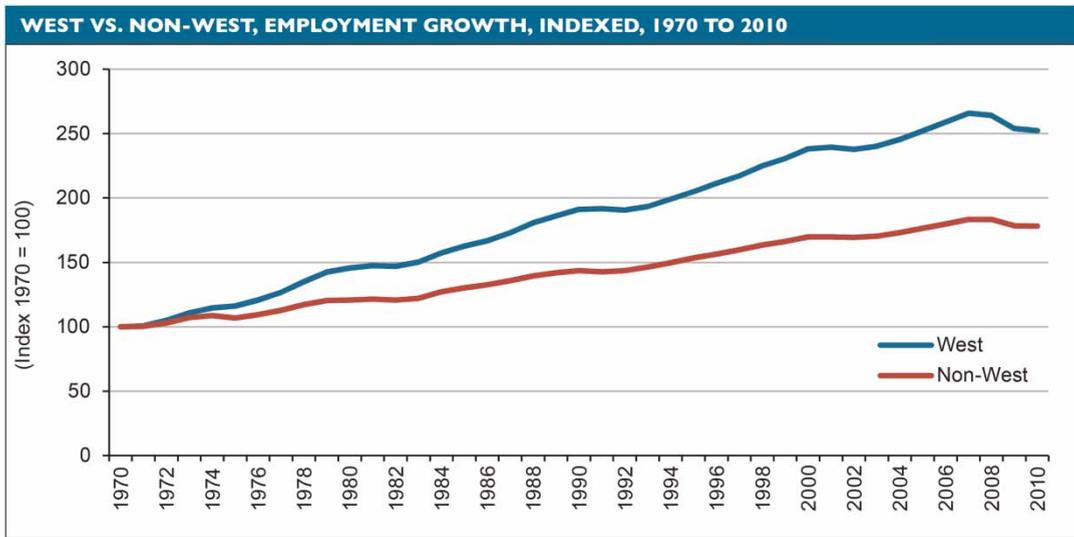


Fig. 3. Total employment, West vs Non-West, 1970–2012 (Rasker, 2012). For up to date statistics, see <http://headwaterseconomics.org/>.

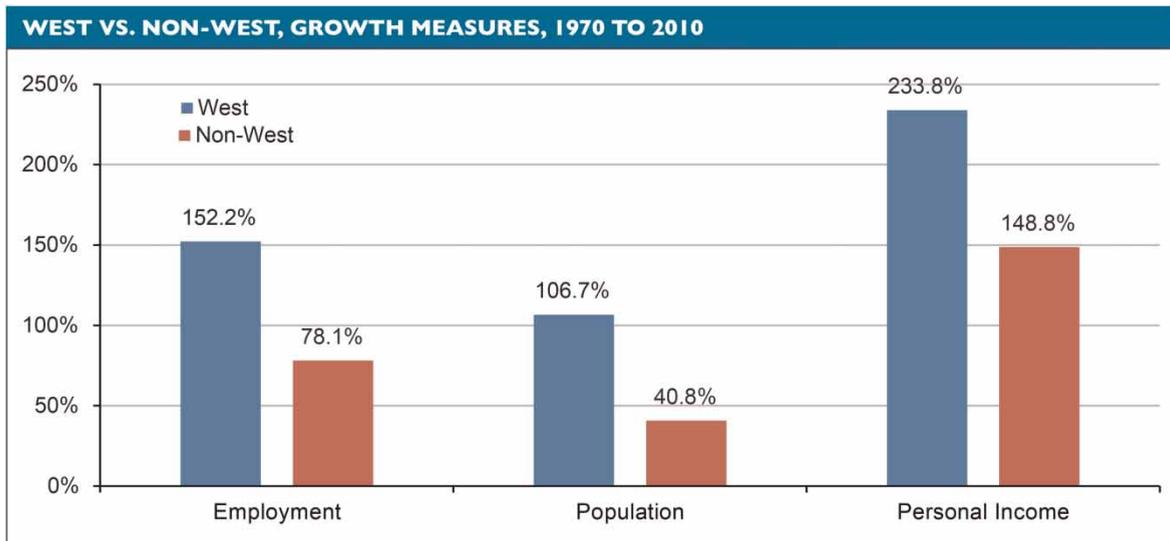


Fig. 4. Population, employment, and real personal income, West vs Non-West, percentage change 1970–2012 (Rasker, 2012). For up to date statistics, see <http://headwaterseconomics.org/>.

primary approach to water management and conflict resolution for each major phase of human settlement and development – clarifying how social circumstances and values changed, and how these changes compelled the need for new conflict resolution methods. The Appendix (available online at <http://www.iwaponline.com/wp/017/146.pdf>) summarizes the key themes and conflict resolution methods defining the foundations of water conflict resolution in the American West.

Megaregions in the American West

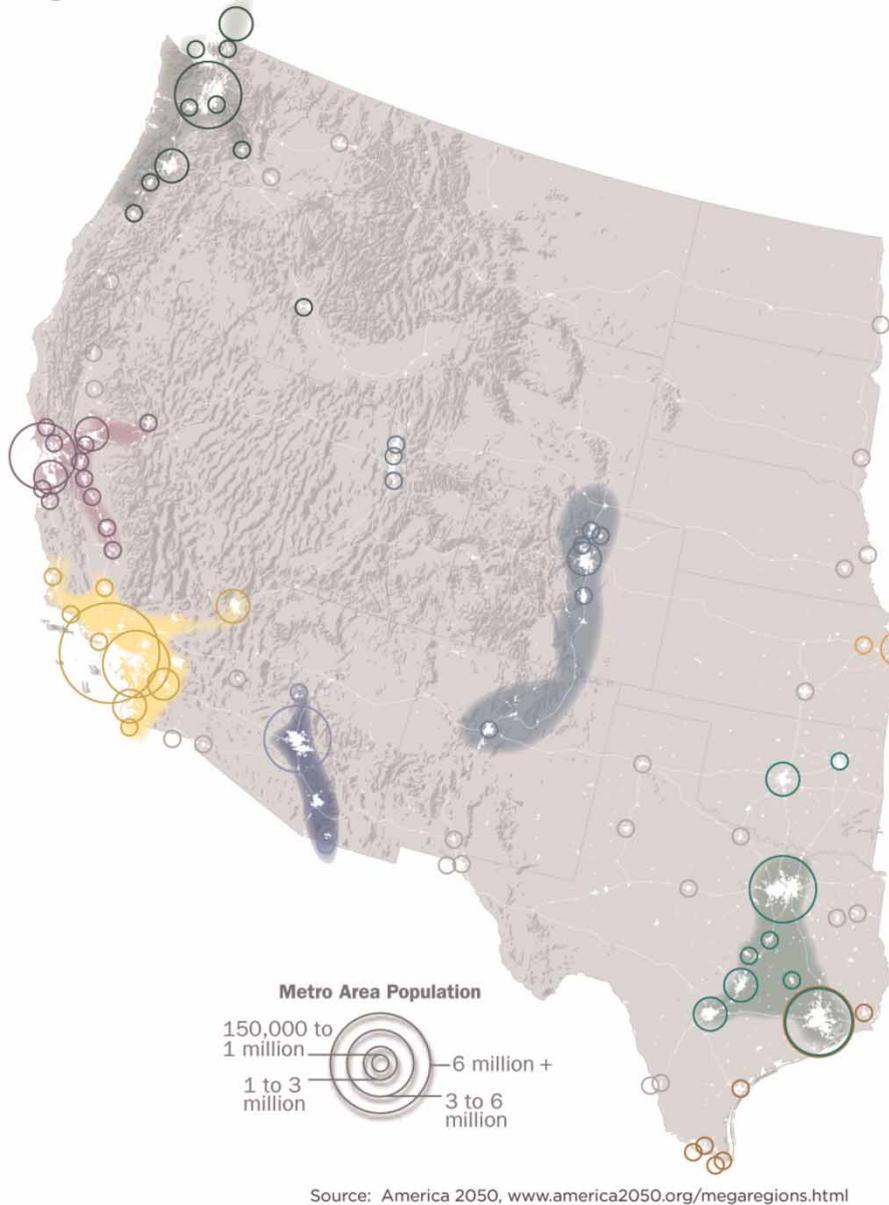


Fig. 5. Megaregions, American West.

3.1. Ancient wisdom

Long before Europeans ‘discovered’ the New World, indigenous people inhabited the American West for thousands of years (Figure 7; Gibson, 1980). Like other civilizations, these people struggled in

Climate change, growth to heighten water conflicts

Clash between population trends and needs of endangered species

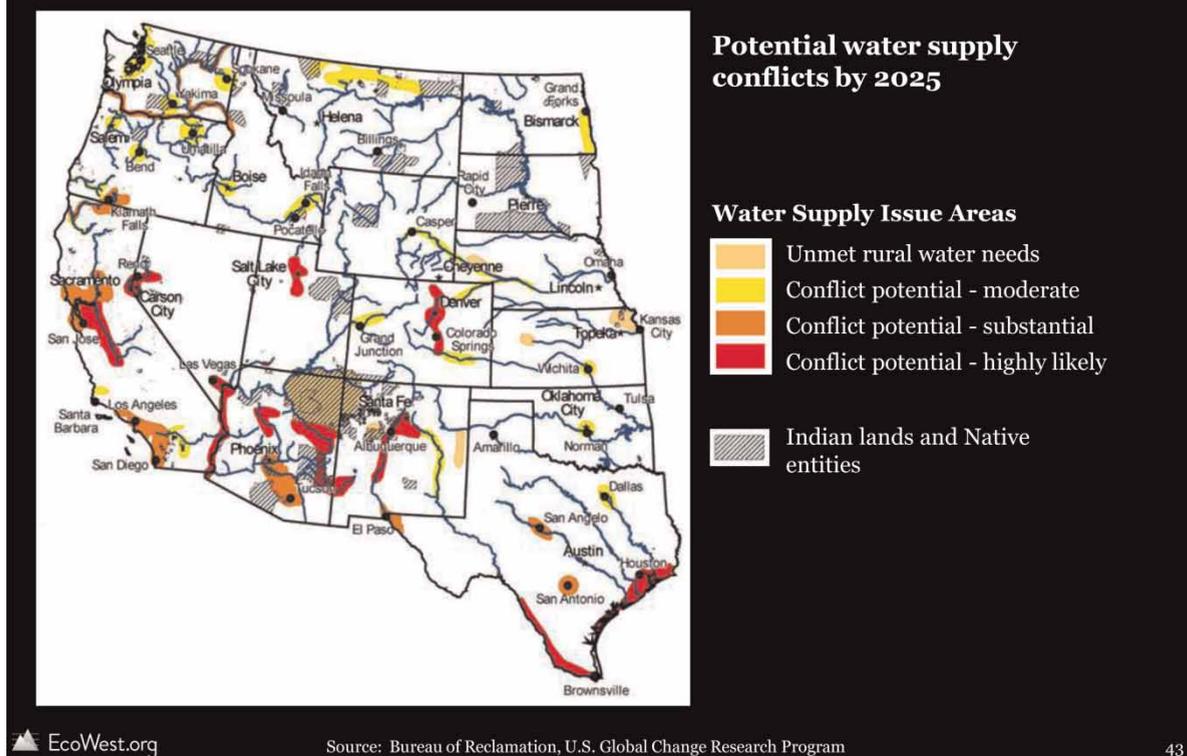


Fig. 6. Potential water supply conflicts (2025), western United States.

different ways to secure adequate water for their crops and homes. Water was central to the religious beliefs and economic practices of Native Americans.

The Hohokam developed the first large irrigated agricultural community in Arizona's Valley of the Sun. Segments of their 125-mile canal system are still used today by Phoenix-area irrigators. How the Hohokam organized themselves to provide the labor necessary to remove millions of tons of earth to form these canals and cultivate the fields that accompanied them is not known. Nor is it clear how this society resolved disputes over water¹.

¹ Aaron Wolf's African research (Wolf, 2000) addresses this issue by investigating 'how indigenous peoples of two drylands regions (the Berbers of the High Atlas Mountains and the Bedouin of the Negev Desert) approach negotiations brought about by water scarcity and fluctuation...'. His work documents certain conflict-resolution methods in those cultures distributing water in units of time rather than in units of volume; prioritizing uses in a hierarchy of importance; certain protections for downstream and minority rights; sophisticated mechanisms of dispute resolution including recognition of a defined water authority and 'shared vision' exercises; and practice of the 'sulha', the Islamic ritual ceremony forgiving past disputes. Indigenous communities in the American West may have used similar methods.



Fig. 7. Tribal distribution (1500), present western United States boundaries (Gibson, 1980).

While not practicing irrigated agriculture, other North American indigenous people relied on water for a variety of social purposes. Because of their modest uses and the relative abundance of water in most areas, inter-tribal cooperation was usually not necessary for survival. In the Pacific Northwest, however, evidence survives of intra- and inter-tribal competition over prime fishing sites where, during a few days each year, much of a tribe's annual food and necessities were secured.

When disputes arose concerning water within a tribe they were most often resolved by a leader or group of elders after consultation with tribal members (as with most problems facing tribal groups). Research on indigenous approaches to conflict resolution suggests that elders played a critical role as facilitators and peacemakers (Walker, 2001). In this context, the peacemakers (or elders) were not formally trained. Rather, these elders learned by observation and listening in natural settings throughout their lives. They demonstrated wisdom through their spirituality, good works, and personal achievements. These elders remembered and articulated the traditional beliefs and values of the tribe, thus maintaining the respect of the community. Elders were able to give advice in ways that sustained both civic and spiritual values.

Tribal groups also had conflicts with one another. Some of these conflicts resulted from long-standing cultural feuds or seasonal raids for goods and wives. Other inter-tribal conflicts resulted as tribes differentially aligned themselves with the United States, England, France, and Spain, which were involved in

their own competition for western lands. Still other tribal conflicts resulted when the United States government relocated certain tribes to lands already occupied by other tribes. Typically, these conflicts were resolved by force or left to fester (Hoig, 1993).

3.2. *Spanish conquest*

The Spanish brought their own cultural perspectives about water when they colonized the South-west starting in 1520. Influenced by Roman law and other sources, the Spanish developed water law doctrines and transferred water management experience from the arid region of their country. Still, the Spanish faced the considerable challenge of managing a vast New World empire from a distance of over 5,000 miles with the fastest mode of two-way communication being a lengthy round-trip sailing voyage (Meyer, 1984).

In some places, such as the Indian Pueblos along the Rio Grande where existing ditches were used by natives and newcomers alike, the Spanish influence became assimilated into the cultural practices of the Indians. By 1650, almost 400,000 individual royal pronouncements had been issued by Spain to govern the New World; however, without an integrated, organizational scheme, these rules were of little use to colonial officials.

The Spanish were forced to develop new approaches to govern from such a distance. King Alfonso X codified Spanish law in 1260 in a historic document called ‘Las siete partidas’. A version of this document – ‘Recopilación de leyes de los reynos de las Indias’ – was adapted for the New World in 1681. Among other things, it decentralized authority among numerous local officials in the colonies and provided them with broad policies and guidelines to assist them in discovering and applying the Crown’s will (Meyer, 1984).

This body of law set forth pragmatic and equitable principles, criteria, and procedures for resolving disagreements over water in the Spanish colonies. Legal title and prior use were to be honored but they did not defeat the claims of especially needy people, the changing needs of the Crown, important third-party rights, or the common good. Spanish law compelled decision-makers to weigh these multiple interests to avoid ‘winner takes all’ solution. One way this theory was operationalized was the creation of ‘acequias’ – community-based water management organizations found along rivers and streams in northern New Mexico. Many of these acequias survive to this day. Among other things, members of these community-based organizations cooperate seasonally to clean the ditches. A ‘mayordomo’ (or ditch rider) supervises distribution and resolves disputes, frequently using the passed-down principles of Spanish law.

3.3. *Euro–American settlement*

Spanish influence in the South-west declined with Mexican independence in 1821 and rapid American settlement following the 1849 Gold Rush. Water was essential to the mining operations in the Sierra Nevada mountains (California and Nevada) and the Rocky Mountains. It was also necessary for the many coastal or low-land communities that developed as trading centers for the mining industry. Water was also essential to the Mormon farming communities that originated near Salt Lake in 1847 and proceeded south along the Wasatch Front and north into Idaho.

The coastal residents, miners, and Mormons introduced three different approaches to resolving conflicts over water. Along the Pacific Coast, the residents applied what they knew. Old-timers practiced the

Spanish law that had accompanied the missions and land grants. Increasingly, newcomers applied riparian law, a regime that had been developed in England and refined in the eastern states where water was rarely in short supply. Under riparian law, only landowners along the waterway can use water, and they must do so in reasonable amounts and ways.

In the mining camps of California and Colorado, water was scarcer. Here, the residents also applied what they knew: the laws and customs of mining. Mining law had its origins in Roman law, which recognized ownership of a mining claim according to the principle of the ‘first in time, first in right’. In acquiring water for hydraulic mining or milling, the American miners informally acknowledged this principle, as well as the utility of diverting water away from waterways for beneficial purposes. These principles ultimately became the West’s prior appropriation doctrine, which continues today as the foundation for allocating water and resolving disputes among water users (Hundley, 1992).

In settling the Salt Lake Valley, Brigham Young and his advisers realized that efficient, fair use of water, as well as significant cooperation, would be indispensable to their religious community’s success. Soon after arriving in Utah in 1847, Mormon leaders platted an entire city with wide boulevards, individual homesteads with gardens, and farming and grazing fields along the perimeter of the settled area. Each parcel had access to water, and a series of church officials were appointed to oversee the distribution of water and to resolve any disputes.

The residents worked together to capture and deliver this water and developed many of the technologies and social institutions that were later employed in the national reclamation movement. In this culture, water was a community resource to be managed and distributed in order to meet the community’s needs. Only in 1880 did this communitarian characteristic give way to the spreading-prior-appropriation doctrine and its emphasis on water as a private property right (Dunbar, 1983).

3.4. The reclamation movement

As the West continued to grow around the turn of the 20th century, private and local capital to develop and deliver needed water proved to be insufficient. This development, combined with the community-based experiences of the Mormons, provided much of the inspiration for passage of the federal Reclamation Act of 1902 (National Reclamation Act, 1902). According to the architecture of this legislation: (1) the federal government would advance the capital and its engineering skills to build the necessary dams, reservoirs, and conveyance structures; (2) local farmers would organize and pledge their water rights to the project, suffer liens on their farms to secure project costs, and eventually manage the projects; and (3) as the farmers paid off their debt, capital would be available for other reclamation projects. For reclamation projects near Indian reservations, such as along Nevada’s Truckee River (Newlands Project) and Arizona’s Gila River (San Carlos Project), an additional benefit was envisioned. Indian lands would receive water from the project, and the federal government, in fulfillment of its responsibilities to the Indians, would pay for a portion of the project (McCool, 1987).

Consistent with the Progressive Era philosophy of scientific management, federal officials also encouraged the professionalization of state water management through the promulgation of the *Bien Code*, a model state water law that was premised on a strong administrative agency known as the state engineer (Hays, 1959). The state engineer would oversee a permitting system for new water rights and the transfers of those rights. Disputes over new rights would be handled initially as a matter of administrative law, with ultimate resort to the courts. The state engineer would also have

an important role in commencing general stream adjudications (large lawsuits to determine existing water rights), conducting initial hearings, and proposing schedules of rights to the court.

Because sufficient water supply was crucial to a successful reclamation project, the federal government often required general stream adjudications on rivers planned for development. Although many of these proceedings took years to complete, they were usually non-controversial – at least as to the rights of the non-Indians. Water users would appear before court on the appointed day and provide testimony on their water rights. Unfortunately, many of these proceedings resulted in the permanent, wholesale discounting of Indian water rights². Over the years, reclamation projects involving both Indian and non-Indian lands have been continuously afflicted by a host of divisive issues such as who manages the project, whether water can be used on non-project lands, and whether project water can be used on reservation lands subsequently allotted to individual Indians or non-Indians (McCool, 1987).

Within the first few decades of the 20th century, the communitarian values of water – expressed in the practices of Native Americans, some elements of Spanish law, the early practices of Mormons, and certain features of the reclamation program – were overshadowed by a growing private property rights emphasis on water. The push to establish professional administrative permitting agencies (such as the office of the state engineer in many states) ironically encouraged this trend by regularizing the acquisition and transfers of such property rights. The ‘water as private property’ concept had the advantages of providing title to a resource; encouraging private effort and investment to improve the resource; and fitting in well with the legal, financial, and dispute resolution systems developed for other private property rights. Water disputes, like other property law matters, found their way into civil court for resolution. The tension between community-based approaches to water management and conflict resolution and private property approaches continues to be a defining theme even today.

3.5. *Evolving federal role*

While local water use became increasingly oriented around the private property concept, the federal government expanded its role in the early 20th century to protect the larger public interest in the nation’s waterways. In two specific ways, the US Constitution requires the federal government to (1) facilitate interstate commerce and (2) resolve interstate disputes.

Because navigable rivers are important corridors of interstate commerce, the federal government commenced its water management role in 1824 with the US Army Corps of Engineers removing debris from rivers and, later, dredging and channeling major waterways such as the Mississippi, Missouri, Columbia, and Saint Lawrence. By the 1920s, the federal role expanded with the passage of the Federal Water Power Act (Federal Water Power Act, 1920), giving an independent federal commission authority to regulate hydropower production on navigable rivers, and the commencement of river basin planning (usually focused around a major dam) to achieve the multiple-use objectives of the conservation movement that greatly influenced natural resource management at the time (Hays, 1959).

² See, for example, Nevada’s Orr Ditch Decree, where the federal government participated in a stream adjudication to assist the Newlands Reclamation Project but asserted no claims for water necessary for the tribal fishery. When the Pyramid Lake Paiute Tribe sought to reopen this decree in the 1980s, it was rebuffed by the US Supreme Court in *Nevada v United States* (1983).

In an effort to combat the effects of the economic depression of the 1930s, the federal government stepped ahead to construct many multiple-use projects including Fort Peck Dam on the Missouri River, Hoover Dam on the Colorado River, and Grand Coulee Dam on the Columbia River. Because these projects seemed essential to national interests, there were few dissenters at the time over the goals of these projects. As with all public policies, however, there were many disputes over the implementation.

Some of these disputes were resolved during the planning process³. Other disagreements were resolved by political bargaining⁴. Increasingly, technical experts and politicians – mostly based in Washington DC – made major decisions affecting water use and management in the American West. Citizens without access to these venues of power had little ability (other than their vote) to impact the decision-making process.

The high point of this federally driven, comprehensive river basin development approach came in 1965 with the passage of the federal Water Resources Planning Act ([Water Resources Planning Act, 1965](#)). One of the principal provisions of the Act was authorization for inter-agency river basin commissions on major river systems, each with professional staff. These commissions were an innovative approach to federal–state relations, but many of them became obsessed with the planning process, producing endless iterations of water development plans for a basin. Ultimately, President Ronald Reagan abolished all these commissions in the first months of his administration.

The other major role of the federal government as provided by the US Constitution is to resolve interstate disputes. As America developed during the 20th century, the nation's waterways were used for navigation, electric power production, municipal water, irrigation water, and water for industrial processes. It was inevitable that disputes would arise between states over the use and control of interstate rivers. These interstate disputes have been resolved in three ways.

First, the US Constitution (Art. III, Sec. 2) grants the US Supreme Court original jurisdiction to hear disputes between states (US Constitution). For the first 130 years, as the nation rapidly grew westward, this authority was used to resolve boundary disputes between states when surveys proved to be incomplete or inexact. Since 1907, when the Court resolved a dispute between Kansas and Colorado over the Arkansas River ([Kansas v Colorado, 1906](#)), interstate water right disputes (frequently over western rivers) have been the more common reason to invoke the original jurisdiction of the Supreme Court.

The Court has entertained lawsuits involving the Colorado River ([Arizona v California, 1963](#)), the Pecos River ([Texas v New Mexico, 1980](#)), the Vermejo River ([Colorado v New Mexico, 1982](#); [Colorado v New Mexico, 1984](#)), and the Platte River ([Nebraska v Wyoming, 1945](#)), among others. In the process, the Court has developed a tailored body of 'equitable apportionment' principles to resolve these cases ([Tarlock, 1985](#)). This flexible jurisdiction, having remarkable similarity to the Spanish 'Recopilación'

³ For instance, disagreement between the Corps of Engineers and the Bureau of Reclamation over which agency would develop the Missouri River was resolved when officials of both agencies agreed to combine their plans into one package (the Pick-Sloan plan) for submission to Congress.

⁴ As the price of securing his support for the Missouri River Pick-Sloan plan, Wyoming Senator Joseph C. O'Mahoney insisted on an amendment that would guarantee that upper basin consumptive uses would have priority over lower basin navigation uses ([Thorson, 1994](#)). Similarly, Arizona secured its Central Arizona Project, bringing Colorado River water as far as Tucson, by accepting a low priority on the river.

discussed previously, acknowledges that relative priorities on an interstate river will be honored, but no one state will be allowed to monopolize a river or use its water wastefully⁵.

The second method for resolving water-related disputes between states is by Congressional apportionment. Ultimately, in interstate litigation involving the Colorado River, the Supreme Court recognized that Congress had earlier apportioned the lower river among Arizona, California, and Nevada with the passage of the Boulder Project Storage Act, the legislation authorizing the Hoover Dam (*Arizona v California*, 1963).

Third, the US Constitution (Art. I, Sec. 10) allows states the ability, with Congressional permission, to resolve their own disputes by interstate compact or agreement. The compact approach was pioneered by efforts to settle disputes over shared waterways. This method is now used for a variety of purposes, such as siting low-level nuclear waste sites and providing regional educational programs. Congress has approved approximately 35 water-related compacts, with more than 20 of them in the West (Figure 8). These compacts fall into four categories: water allocation, pollution control, flood control and comprehensive water regulation, and project development (Muys, 1971). The agreements themselves occasionally provide dispute resolution procedures.

Interstate water compacts have fallen into disfavor as a means for resolving disputes over shared waters⁶. They usually take many years to negotiate and steer through Congress. Problems that were thought to have been resolved have a way of reappearing during implementation. The compacts have been perceived, somewhat unfairly, as locking the states into an inflexible legal regime that allows little maneuvering to solve new problems. Compacts also do not permanently avoid litigation, as Texas' recent US Supreme Court suit (No. 141, Original) against New Mexico concerning alleged violations of the Rio Grande Compact demonstrates. However, as a recent empirical study of 14 interstate water compacts has concluded, 'compact commissions are quite capable of resolving a variety of conflicts as they interpret and administer the terms of compacts, particularly in partnership with other venues, and thus wholesale revisions may not be necessary...' (Schlager & Heikkila, 2009, p. 18).

4. Modern approaches

Modern approaches to water conflict resolution in the American West are built on the foundational principles and methods, most of which still play an influential role in allocating water rights, managing water, and resolving conflict. In this section, we discuss water conflict resolution in the context of

⁵ In practice, considerable resources are devoted to the resolution of these cases and, in some respects, they represent the apex of the American water law system. The cases are initially assigned to a special master – an attorney or senior judge with outstanding credentials. The states hire the best legal and technical talent to prepare their case, the cost of which often runs into the millions of dollars. After the special master completes hearings, the entire Supreme Court hears arguments on the master's report, often devoting considerable time to the hearing. In litigation concerning the Colorado River, the Supreme Court conducted an unprecedented 2 days of arguments by the states and later scheduled a rehearing after one of the justices died and was replaced. These cases can rarely be completed in less than 5 years. Often, aspects of the litigation extend over several decades. Starting in 1931, Arizona attempted to invoke the Supreme Court's original jurisdiction to hear litigation over the Colorado River. The Court finally agreed in the 1950s and finally reviewed the master's report in 1963–1964 (*Arizona v California*, 1963; *Arizona v California* (Decree), 1964). The Court addressed a lingering aspect of the litigation, water rights for disputed tribal lands, in an opinion issued in June 2000.

⁶ In 2008, Congress did approve an eight-state compact, the Great Lakes – St. Lawrence River Basin Water Resources Compact that built on earlier, less formal agreements among many of the states and the adjoining Canadian provinces.

Interstate Water Compacts in the American West

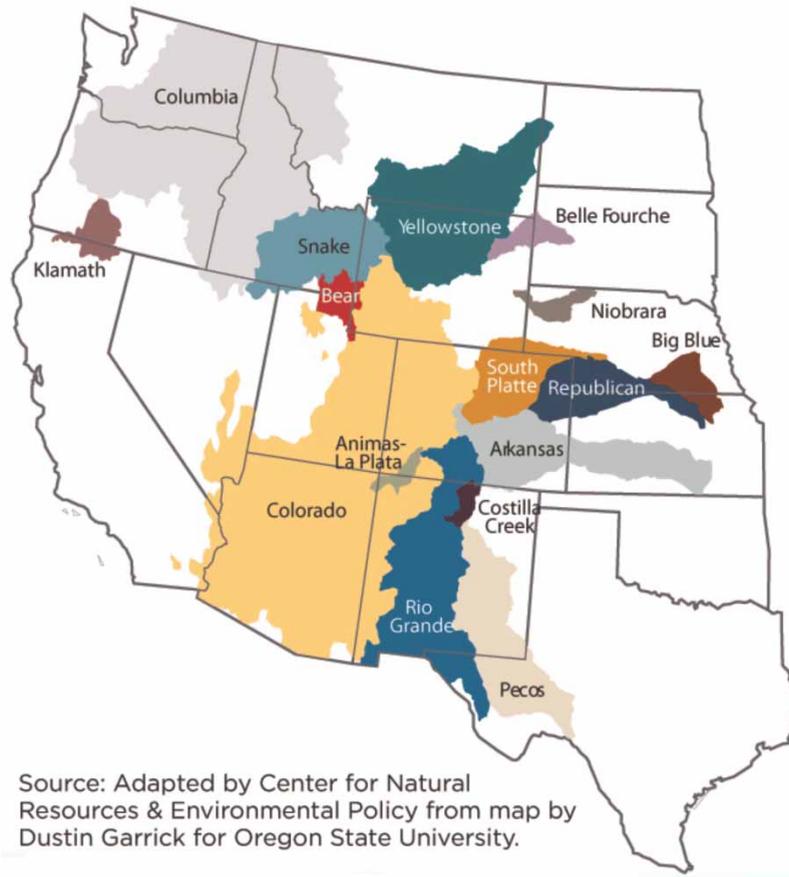


Fig. 8. Interstate water compacts, American West.

national environmental law, adaptive management, reserved water rights, interstate and local water conflicts, and water markets. Refer again to the Appendix (available online at <http://www.iwaponline.com/wp/017/146.pdf>), which identifies the key themes and strategies that define modern approaches to water conflict resolution in the American West.

4.1. National environmental law

Beginning with the **National Environmental Policy Act (1969) (NEPA)**⁷, national environmental laws have significantly influenced water conflict resolution in three significant ways. First, NEPA, the Clean

⁷ Utilizing the ‘environmental impact statement’ process, agencies are required to account for the impact of proposed actions on environmental values, and citizens can sue to enforce the proper preparation of these documents. Citizen suit provisions are available under many of the other statutes as well (see Miller, 1987).

Water Act, and the Endangered Species Act (ESA) – among others – have compelled agencies to seriously consider environmental values in making decisions. Taken together, these statutes established a more open, transparent decision-making process that requires agencies to offer ‘notice-and-comment’ opportunities for the public to provide input and advice on proposed agency decisions; allow citizens to initiate lawsuits to ensure that agencies fulfill their statutory requirements; and encourage judges to defer to agency expertise unless the agency acts in an arbitrary and capricious manner. This framework – replicated to a greater or lesser degree in the states – fundamentally altered the process of formulating and implementing environmental policy. Whereas these matters had formerly been within the closed domain of professionals and politicians, agency decision-making processes were now opened to an unprecedented degree.

While these statutes improved public participation and the consideration of environmental values in decision-making, they also catalyzed new areas of conflict. Before long, litigation brought under these laws became an effective way for some citizens and interest groups to stall or defeat a proposed action or project. For example, the US Army Corps of Engineers initiated a process in 1989 to rewrite the ‘Master Manual’, the policies for operating the massive dams along the Missouri River, the longest river in America. Many constituencies supported these changes including environment agencies and organizations concerned about endangered fish and birds along the river. The basin states even reached an agreement on the principles for a new manual. However, the Corps and the US Fish and Wildlife Service disagreed about the protection of threatened and endangered species. Numerous states, commercial interests, and conservation organizations brought suit in various courts to stop or modify the process. It took the Corps until 2005 – 16 years after the decision-making effort began – to complete the environmental impact statement (EIS) and adopt a new Master Manual.

This short story also illustrates the second major way in which national environmental laws influence water management and conflict resolution. In some cases, agencies (such as the US Fish and Wildlife Service) have regulatory authority that often acts as another form of water rights – so-called regulatory water rights – competing with other rights in water-short basins. Such was the case with threatened and endangered species in the Missouri River. The regulatory water rights associated with the [Clean Water Act \(1972\)](#) and the [Endangered Species Act \(1973\)](#) have been central to many conflicts over water in the American West.

Under Section 404 of the Clean Water Act, the Corps of Engineers is given permit authority to review projects that might involve ‘dredge and fill’ of the nation’s waters. This authority has been used broadly to review dam proposals, coastal projects, and activities involving wetlands. The Section 404 process ultimately resulted in the cancellation of Denver’s plans to build the controversial Twin Forks Dam on a beautiful stretch of the Platte River. After completion of a 6-year and \$25 million EIS, the Corps was prepared to issue a permit for the project. However, in November 1990, the Environmental Protection Agency vetoed the permit under its Section 404 authority, citing the unnecessary environmental harm that would result from the project ([Luecke, 1999](#)).

Perhaps more than any other national environmental law, the ESA has been central to many conflicts over water. One of the early environmental battles concerned Tellico Dam, a project on a river in Tennessee. When the dam was substantially complete, environmental groups successfully sued to prevent the closing of the gates, saying that the snail darter, a fish listed as threatened under ESA, would be jeopardized ([Tennessee Valley Auth. v Hill, 1978](#)). In the West, a settlement invoking the Colorado Ute Tribe was scaled back and jeopardized because of endangered fish concerns along the Animas-La Plata Rivers ([US General Accounting Office, 1995](#)). Today, 50 fish species listed under the ESA

are linked to agricultural activity, and 235 counties contain irrigated production that relies on water from rivers with ESA-listed fish (Moore *et al.*, 1996). The ESA's requirements for protecting salmon, steelhead, and native inland species condition water use and hydropower production along the Columbia River (Volkman & US Western Water Policy Review Advisory Commission, 1997). Species recovery may require the modification or removal of some basin dams to facilitate fish migration. In the 1990s, similar issues emerged in the Colorado River basin including challenges to restrict the operation of the Hoover Dam, the key to water and electric power distribution in the Southwest, to protect the nesting of the willow fly catcher.

As a result of the intensity, complexity, and tenacity of these conflicts, public officials and others have experimented with new forms of conflict resolution – the third major contribution of national environmental laws to western water conflict resolution. Because these disputes involve local, state, and federal agencies, and revolve around scientific uncertainty, specially tailored collaborative entities have been convened to bring all the necessary parties to the table with the best available information. Frequently, non-agency stakeholders have been included to advise or even participate in the decision-making process.

California's Bay-Delta region, the largest West Coast estuary, has been embroiled over water quality and ESA-listed fish for some time. The innovative CalFed process brought more than two-dozen federal and state agencies together from 1994 to 2010 in a specially tailored forum to implement recovery solutions (and made significant progress). Elsewhere in the West, multi-species recovery committees on the Platte River and Upper Colorado River have had some success in reducing conflict and recovering ESA-listed species. In the Missouri River, federal agencies have convened a 70-member sovereign-stakeholder committee, known as the Missouri River Recovery Implementation Committee (MRRIC), to reach consensus among federal, state, tribal, local, and interest group representatives on the best strategies for recovering ESA-listed fish and bird species. MRRIC created an Independent Science Advisory Committee to provide the best available scientific knowledge on key issues. Other methods for accessing scientific expertise and promoting joint fact-finding include referrals to the National Research Council (NRC) of the National Academies of Science. The NRC has issued major reports on the Columbia, Colorado, Klamath, and Missouri River in recent years.

While national environmental laws injected environmental considerations into decision-making and created new opportunities for citizen participation, avenues for appeal, and opportunities for litigation, some of the procedural and citizen suit provisions resulted in complex bureaucratic processes, endless litigation, and decision-making paralysis.

4.2. Adaptive management and governance

By the turn of the 21st century, national environmental laws reached their limits in terms of generating sound policies and resolving conflicts – leading to the search for new decision-making and conflict resolution approaches. These early statutes are premised on a two-phase decision-implementation process (Ruhl & Fischman, 2010). In phase one, procedures prior to an agency's decision are relatively open and participatory. However, once the agency reaches its final decision, it assumes a more defensive role in resisting legal challenges and is constrained by the prior decision parameters during implementation. While learning can occur and the earlier decision can be modified, the change process is usually formal and time-consuming. Compared to the phase-one-decision process, the phase-two-implementation process is less flexible and less responsive to change. In terms of conflict resolution, agencies

have learned that conflict does not end with the agency's final decision; rather, conflict is a perpetual process that often must be managed throughout the program's life.

As early as 1978, C. S. 'Buzz' Holling and others began advocating for more flexible resource management, now commonly known as adaptive management. According to this approach, '[A]daptive management ... is more evolutionary and interdisciplinary, relying on iterative cycles of goal determination, model building, performance standard setting, outcome monitoring, and standard recalibration' (Holling, 1978). Recognizing the ever-changing nature of social, economic, and ecological systems, adaptive management is now practiced to varying degrees by all major federal resource management agencies.

Increasingly, these adaptive management methods are encompassed within broader policy efforts of adaptive governance with accompanying special challenges for public participation and conflict resolution. Susskind and others refer to this merged approach as 'collaborative adaptive management' (Susskind *et al.*, 2010). To the extent that an agency adopts a flexible, iterative decision process, uncertainty increases for disputants who must now commit to a continuing process. Rather than achieving a final settlement, they must defend their gains and interests perpetually. Resource agencies place a high premium on stakeholder and public participation in adaptive governing processes; however, these agencies are struggling with identifying the most productive means for such involvement. Calls for 'adaptive governance' are easy to make, but difficult to achieve. Agencies have convened ad hoc groups, such as MRRIC, to advise on adaptive management plans but they struggle with the role and authority of such groups, the difficulty of reaching a decision or consensus in such settings, and the overall costs and time necessary for such extraordinary processes.

Recent research suggests that the successful application of adaptive governance to water conflicts depends on addressing five key challenges: (1) representation, or who should be involved? (2) decision process, or how can authorities and stakeholders reach mutual-gain solutions? (3) scientific learning, or how can policy-makers develop and use knowledge effectively? (4) public learning, or how can resource users and the relevant public develop a common understanding of the issues, options, consequences, and solutions? and (5) problem responsiveness, or how well do decisions achieve social, economic, and environmental goals? (Scholz & Stiftel, 2005). In an evaluation of collaborative adaptive management concerning Glen Canyon Dam, Susskind concluded that problem-solving procedures, organizational infrastructure, stakeholder communication, and agency learning are crucial to success (Susskind *et al.*, 2010).

4.3. *Negotiating reserved water rights*

While national environmental laws emerged and influenced the nature of water conflict resolution in the West, the water right claims of Indian tribes and federal agencies resulted in a separate set of conflicts and pioneering conflict resolution efforts. Under the federal reserved water rights doctrine, many Indian tribes have senior but unquantified claims on western rivers (Fisher, 1984). Federal natural resources agencies, such as the National Parks Service and US Forest Service, also have claims to water necessary for the federal lands and resources. The unresolved nature of these claims creates uncertainty for other water users on the river. Efforts to litigate these tribal and agency rights in general stream adjudications have been expensive, time-consuming, and often result in needless conflict (Colby *et al.*, 2005).

Since the 1980s, water users have resolved these reserved right claims through negotiation and mediation, rather than through the cumbersome stream adjudications. Montana established a compact commission, a specialized agency to negotiate ‘sovereign-to-sovereign’ with tribes and federal agencies (Marseille, 1983). Similarly, the Idaho governor appointed a special team to conduct negotiations. In Arizona, private water users have taken the lead in negotiating with the tribes and federal government (Colby *et al.*, 2005; Thorson *et al.*, 2006).

The results of this negotiated approach have been impressive: 27 compacts or settlement agreements involving tribes in 10 states have been negotiated and several other settlements involving federal agencies have been completed (Native American Rights Fund, 2011). Often these compacts or agreements include dispute resolution provisions – such as a three-person dispute resolution process in several of Montana’s compacts or a court-appointed water master – to address future conflicts and avoid litigation.

Other negotiations have been more difficult to conclude, even when mediators have been involved. In Arizona, tribal claims in both the Little Colorado River and Gila River adjudications were turned over to a settlement judge who had mixed success. The same judge concluded a tribal settlement (the ‘Aamodt’ case) in New Mexico. In Idaho’s Snake River adjudication, a seasoned mediator successfully worked with the parties over several years to complete the Nez Perce Settlement. Workshops were held in 2000 for stakeholders in Oregon’s Klamath River basin adjudication, helping them understand how mediation might help resolve litigation involving claims of the Klamath Tribe. Workshops have been conducted even for judges, helping them learn how to use mediation to help resolve their water law cases.

Even when the negotiators have completed settlements, the agreements may still face a difficult approval process. For instance, a settlement between Montana’s compact commission and the Confederated Salish and Kootenai Tribe has stalled in the state legislature. Even if it clears that hurdle, the federal Congress and the state water court still must approve it. While not perfect, experience suggests that negotiation of reserved water rights is more likely to solve more problems, and in a more harmonious way, than litigation, and often results in mutual-gain outcomes, improves relationships, and becomes easier to implement – in part because the agreements often include funds for projects.

4.4. Sharing water across boundaries

Many of the most prominent water conflicts in the American West are transboundary in nature, meaning that they occur among states and between nations (Canada and Mexico). Earlier in this article we examined alternative approaches to resolve interstate water conflicts, noting that the record is mixed and often leads to ongoing litigation. Historically, western states have been reluctant to involve non-governmental actors in resolving interstate water conflicts. The principal state water officials, usually known as the state engineer or director of water resources, often believe that the costs of informing and educating other stakeholders and non-partisan mediators on technical, legal, and historical issues outweigh the benefits such people might bring to the process.

4.4.1. Role of collaborative leaders. This traditional method of resolving interstate water conflicts has slowly given way to more open, transparent, and inclusive processes that include state and federal officials along with local governments and special districts, interest groups, and tribes. These

multi-stakeholder processes have been catalyzed and convened by ‘collaborative leaders’ who may or may not have formal authority.

In the Colorado River basin, for example, the Secretary of the US Department of the Interior catalyzed and convened a series of informal negotiations in the late 1990s to ensure that California complied with its obligations under the Colorado River Compact. Over the years, the other six states in the basin have almost continuously pressured California to reduce its withdrawals to meet its compact entitlement of 4.4 million acre-feet – whereas California increasingly relied on ‘unused’ water in the upper basin. Although state officials historically maintained private negotiations, the pressure to involve other parties increased as communities, interest groups, and tribes demanded a seat at the negotiation table.

Thanks in large part to the ‘collaborative leadership’ provided by the Secretary of the Interior – who effectively serves as the river master under federal law – California and the six other basin states agreed in 2000 on a 15-year plan to wean California from its reliance on surplus flows. The Secretary formally approved the agreement, which gave increased impetus to negotiations among Southern California water users about how they would achieve the agreed-upon reductions. The internal state negotiations produced the historic Quantification Settlement Agreement that sets forth a host of agriculture-to-urban water transfers and water supply measures. The quantification agreement has faced almost 15 years of intensive litigation.

In a similar way, non-governmental organizations (NGOs) and universities have stepped forward to catalyze and convene forums to inform and invigorate dialogue over transboundary waters. In the mid-1980s, the Northern Lights Institute convened the Missouri River Assembly, concerned that Missouri River basin states were veering toward litigation. The Assembly met several times and consistently engaged over 100 governmental and stakeholder members. Reports, meetings, workshops, and facilitated dialogues were designed to educate people about the river, clarify people’s interests, and imagine creative solutions.

While the Assembly operated without formal authority, it had sufficient legitimacy to convene stakeholders by virtue of its non-partisan nature and commitment to an open, inclusive, informed dialogue. After the Assembly dissolved, the Missouri Basin States Association was reinvigorated and later evolved into the Missouri River Basin Association – including representatives of over 20 Indian tribes in the basin. Today the Association serves as a vibrant regional forum to discuss management of the river. The Assembly structure – a broadly based sovereign-stakeholder group – was emulated by federal agencies when they convened the MRRIC in 2005.

Several other examples – including the Universities Consortium on Columbia River Governance⁸ and the Memorandum of Understanding negotiated by sub-national leaders over the transboundary Flathead River (Locke & McKinney, 2013) – illustrate how unofficial, collaborative leaders are helping resolve transboundary water disputes. These examples illustrate that, while formal, binding agreements to sharing water across boundaries must be ratified through formal decision-making processes, unofficial ‘collaborative leaders’ can play a valuable role in convening, informing, and laying the groundwork for mutual-gain solutions. Collaborative leaders may emerge from formal institutions, such as the US Department of the Interior, or from more informal arenas including NGOs, universities, sub-national leaders, and local watersheds (as we will see in a subsequent discussion of ‘homegrown groups’). Rather than presuming to have all the right answers, these leaders demonstrate the capacity to mobilize

⁸ For more information on the Consortium, see www.columbiarivergovernance.org.

and engage the right people with the best-available information, foster a shared sense of the problem and solutions, and typically have a reputation for serving as an impartial, non-partisan servant of the group. These leaders emulate a growing number of collaborative leaders in both the public and private sectors who ‘are insistent yet not domineering, compelling but not heroic, credible rather than powerful (in the traditional sense), [and] concerned with process...’ (Chrislip, 2002, p. xiv).

4.4.2. Formal conflict resolution organizations. Another modern approach to manage conflict associated with sharing water across boundaries is through formal conflict resolution organizations. One of the oldest such mechanisms in North America is the International Joint Commission (IJC), which was established pursuant to the Boundary Waters Treaty in 1909. The primary purpose of the IJC is to prevent and resolve water conflicts in watersheds shared by Canada and the United States (Figure 9). The IJC’s agenda is largely set by the national governments in the United States and Canada, and consists of a ‘quasi-judicial’ function where it submits binding orders; an ‘investigative’ function that results in non-binding, advisory recommendations; and an ‘alerting’ function that authorizes the IJC to inform and educate the national governments on other issues in the course of its daily functions.

The IJC provides a high-level, formal vehicle to bring together people to address bi-national issues. It is largely viewed as an impartial institution that addresses multiple interests in the process of preventing and resolving water-related disputes. In general, it has been very successful in terms of fostering a more proactive, preventative approach to transboundary issues on shared waterways. The IJC, however, is a small organization responsible for all the transboundary watersheds, lakes, and river systems along the US–Canadian border. A recent evaluation of the IJC concluded that it needs a more strategic framework to clarify priorities and trade-offs, and to clarify how to best use all of its authorities – including the ‘alerting function’ – to fulfill its obligations under the Treaty (McKinney, 2013). The IJC is also working to foster a more integrative, bottom-up approach to watershed management but is somewhat limited by the interests of the two national governments.



Fig. 9. Transboundary watersheds, USA and Canada.

Like the IJC, the International Boundary and Water Commission (IBWC) operates along the US–Mexico border, provides a formal process to address transboundary issues, improves the scientific and technical understanding of such issues, and builds relationships. In adopting Minute 319 in November 2012, the IBWC adopted preliminary, unprecedented measures to provide Mexico with additional Colorado River water during wet years, proactive measures to mitigate and share future shortages, and an Intentionally Created Mexican Allocation so that Mexican water resulting from conservation and new sources may be held in the United States for later delivery to Mexico ([International Boundary and Water Commission, 2012](#)).

More recently, Canada, Mexico, and the United States signed the North American Free Trade Act in 1994. Among other things, this multilateral treaty includes a side agreement, the North American Agreement for Environmental Cooperation, and establishes the Commission for Environmental Cooperation (CEC) to address transboundary environmental conflicts. In one illustrative case, several parties complained about the dewatering of the San Pedro River, which runs north from Mexico into south-eastern Arizona where it meets the Gila River. Water diversions out of the San Pedro River apparently threatened the riparian zone – providing habitat for many migratory bird species. In response, the CEC Secretariat announced in 1997 an independent study by an expert team of five scientists and an attorney. After the report was released in 1999, the CEC reviewed the recommendations and pledged to ‘identify possible roles for the CEC, including identification of possible funding mechanisms, in any potential implementation of the report’s recommendations, consistent with the trilateral mandate of the Agreement and in coordination with ongoing bilateral efforts’ ([Commission for Environmental Cooperation, 1999](#)). The CEC provided funding for some resource management efforts, but most of the team’s recommendations went unheeded.

Given the political nature of these international bodies, they often lack the legal authority and/or political willingness to impose solutions. While serving a valuable and necessary role, these formal methods are often insufficient, thereby reinforcing the need for NGOs, universities, and other ‘collaborative leaders’ to help build agreements and resolve disputes.

Another formal approach for managing conflicts within shared watersheds is to include an explicit dispute resolution process in negotiated agreements over interstate rivers. Two examples illustrate that these mechanisms often fail to achieve their promise. In one case, Kansas sued Nebraska and Colorado in the US Supreme Court in 1998 for unreasonable upstream depletions of the Republican River due to relatively uncontrolled groundwater pumping. Under intensive pressure from the special master appointed by the Court to hear the case, the states negotiated a settlement that ultimately was approved by the Court in 2003 ([Kansas v Nebraska, 2003](#)). The settlement included a graduated conflict resolution procedure – principally two rounds of non-binding arbitration – for future conflicts. Nebraska apparently did not achieve the required pumping reductions, and Kansas triggered the conflict resolution process. After two rounds of unsuccessful arbitration, however, Kansas reopened its case before the Supreme Court and asked for sanctions and other relief from Nebraska.

A similar situation is playing out in the Tongue River, a tributary falling under the jurisdiction of the Yellowstone River Compact Commission. The 1950 compact among Montana, North Dakota, and Wyoming also has a formal conflict resolution process that moves from negotiation, to mediation, and then to non-binding arbitration ([Yellowstone River Compact, 1950](#)). This process failed to resolve Montana’s complaints about insufficient water deliveries from Wyoming. Montana filed a complaint with the US Supreme Court, and a special master appointed by the Court is now hearing the matter.

4.5. *Homegrown watershed groups*

Moving from international and interstate issues to water management at the local level, another modern approach to water conflict resolution in the West revolves around homegrown watershed groups. The inspiration for these methods comes, at least in part, from a famous western explorer, John Wesley Powell. In 1890, after completing a geographic survey of the American West for the federal government, Powell concluded that the most appropriate institutions for governing western land and other natural resources are commonwealths defined by watersheds. He reasoned, '[T]here is a body of interdependent and unified interests and values, all collected in [a] hydrographic basin, and all segregated from the rest of the world by well-defined boundaries. The people in such a district have common interests, common rights, and common duties, and must necessarily work together for common purposes' (Figure 10; Powell, 1890).

Powell's insights were largely ignored as the West was settled, but his reasoning underpins one of the most significant trends in western water (and land) management – the organic emergence of 'coalitions of the unlike' organized around watersheds, river basins, and other ecological boundaries. This movement is consistent with the international best practice of 'integrated water resources management' (see UN Environment Programme, 2012).

Since the 1980s, homegrown watershed groups have multiplied across the West, reaching into nearly every watershed and ecosystem. While the story of each group is unique and organic, they share some common elements in terms of what catalyzes, enables, constrains, and sustains such experiments. First, while watershed groups may emerge after the parties have exhausted other (typically more adversarial) methods to prevent and resolve their differences, there seems to be an increasing commitment to organize such groups as the 'forum of first resort' rather than as the forum of last resort. Second, they are citizen-driven, meaning that they are catalyzed and convened by people who live, work, play, and care about particular places. Homegrown watershed groups rarely operate with any sort of formal government authority and often negotiate with governments about what role agencies will play in the process. Third, these conflict prevention and resolution processes require 'collaborative leadership', that is, one or more people who have the legitimacy, credibility, and capacity to mobilize and engage the right people with the right information to solve common problems. Fourth, the groups are organized around watersheds (or other ecological boundaries) regardless of political jurisdictional boundaries. Fifth, these groups focus on reconciling interests, rather than determining who is right or who has more power.

While homegrown watershed groups may be a 21st century manifestation of Powell's 19th century vision of watershed commonwealths, research suggests that governments still play a critically important role in promoting and supporting such forums. A comprehensive study of watershed groups in the American West concluded that, in most cases, federal agencies remain the primary source of financial resources, technical support, and implementation authority (Kinney & Genskow, 2000). A similar study concluded that government agencies 'sponsored' – that is, convened and supported – 86% of 48 community-based groups included in the study (McKinney & Field, 2008).

These studies seem to suggest that once homegrown, citizen-driven forums become operational, the catalysts realize they must partner with the formal decision-making system if they hope to influence policy and management. Government agencies also have the financial and technical resources necessary to enable and sustain homegrown watershed groups. For their part, public officials seem increasingly open to redefining their own roles, moving away from well-defined expert and decision-maker roles to an amorphous but more useful set of roles as convener, stakeholder, and partner (Wondolleck & Ryan, 1999).

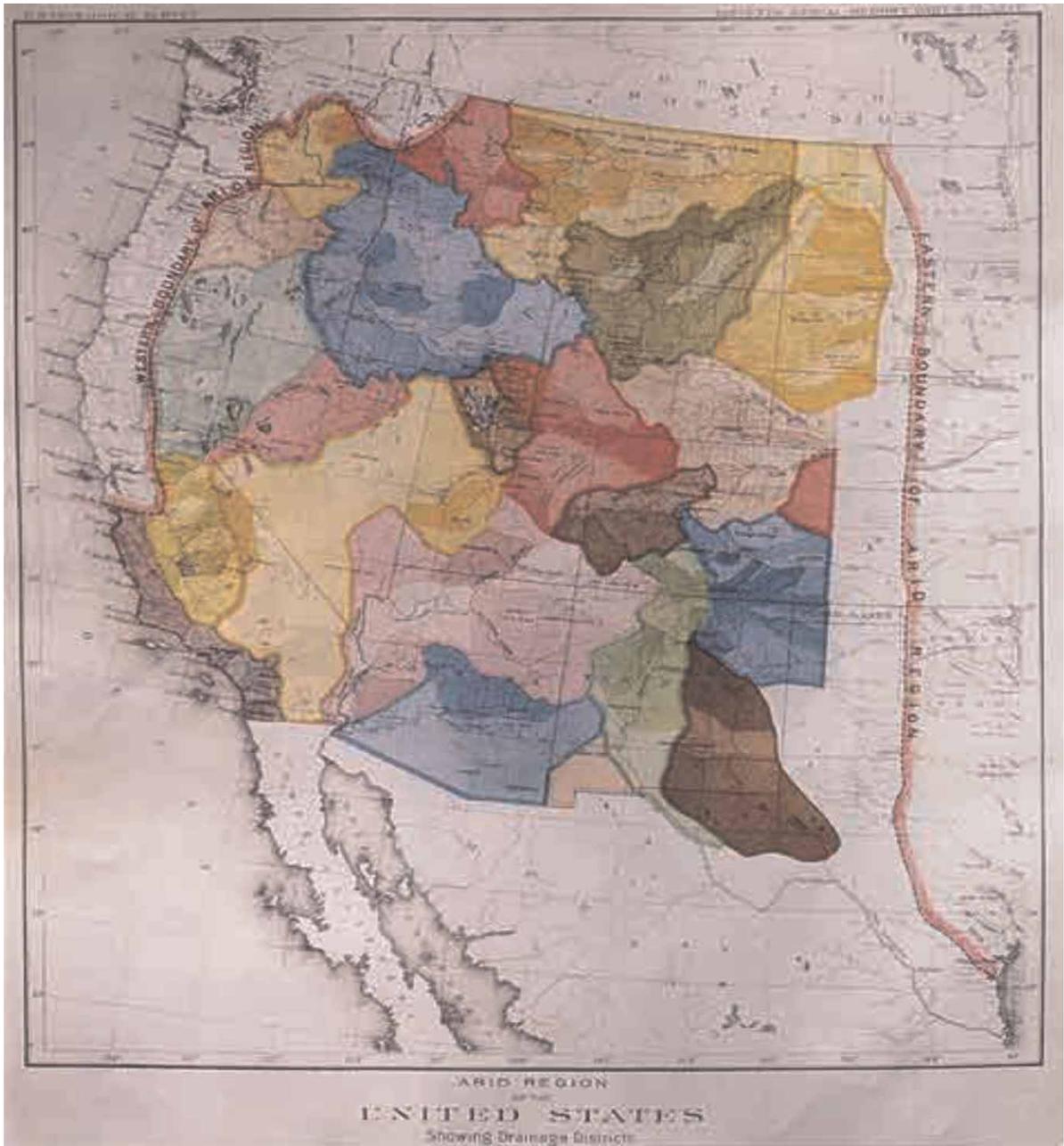


Fig. 10. Powell's map of the arid regions of the American West (1890).

4.6. *Transferring water rights*

The final modern approach to water conflict resolution we wish to discuss is water markets (MacDonnell, 2009; Scarborough, 2010; Western Governors' Association & Western States Water Council, 2012). The

primary role of the economic market is to distribute goods and services in a society. It plays a secondary role in resolving different preferences among competitors. Water markets involve the transfers of water rights, and are playing an increasing role in the West to meet changing demands and manage water conflicts.

Consistent with the prior-appropriation doctrine – one of the foundations of western water law and conflict resolution – water resources throughout much of the West have been allocated to designated users. When people and communities need ‘new’ water, for example, farmers in a drought year, housing developers, or advocates for instream, environmental flows, they must often buy or lease water rights to satisfy new demands. These transactions are known as ‘water transfers’ or ‘water marketing’, and represent another innovative strategy that western states use to adjust to changing conditions, meet new demands, and manage water conflicts.

One of the key elements of water transfers is that they are voluntary. They require a willing seller (or lessor) and a willing buyer (or lessee), and thus require the use of ‘mutual gains’ negotiation – buyers and sellers to work together toward a voluntary and mutually beneficial outcome. Water transfers have occurred for decades, and have proven to be an efficient way to reallocate water and prevent conflict over scarce water resources. As the West continues to grow faster than other regions of the United States, there is an increasing interest in using water transfers to irrigate agricultural lands, ensure sustainable flows through scenic rivers, support valuable fisheries, and quench the thirst of new communities.

According to data presented in [Western Governors’ Association & Western States Water Council \(2012\)](#), the process of selling or leasing water rights has become more commonplace over time. While this database is not all-inclusive, it provides a reasonable picture of trends in water transfers over 20 years (1988–2009) and suggests that water transfers have occurred in all 12 western states. Not surprisingly, states with larger populations and arid conditions (California, Arizona, and Texas) tend to transfer more water in terms of volume. In terms of the number of transactions, however, Colorado is far ahead of other states, completing nearly 2,000 transfers over the span of the data set. This particular database does not track water transfers by purpose of use, but the Political Economy Research Center reports that between 1987 and 2007, state, federal, and private entities restored more than 10 million acre-feet of water to streams through short- and long-term leases, donations, and permanent transfers.

While water transfers offer an effective mechanism to reallocate water, the changes in water-use patterns often have unaddressed externalities such as the dewatering of areas of origin, changes in the amount and timing of flows, introduction of invasive species, and impacts on local economies and culture. Water transfers must therefore consider these potential impacts on local communities and economies. Fortunately, many states have created administrative systems to evaluate these and other potential impacts before approving water transfers.

The transfer of water rights empowers people and communities to satisfy future water demands and resolve potential water conflicts via voluntary, mutual-gain negotiation. Interested parties themselves make decisions, and local conditions and unique needs are accommodated through formal state administrative processes. Water transfers also provide flexibility to accommodate new and emerging uses over time, rather than locking water into a single use in perpetuity. In this respect, water markets facilitate ‘real-time’ adaptive management.

5. Assessment and lessons learned

Four major lessons emerge from this survey of water conflict resolution in the American West. First, there is no single model or approach to managing water conflict in this arid region. Rather, a menu of

ideas and institutions has emerged over time. Each new method has developed in response to the shortcoming of the preceding methods in dealing with changing social, economic, and environmental interests. While these methods emerged at different times and places in the American West, they are now braided together creating a ‘confluence’ of policies, institutions, and habits to prevent and resolve water conflicts in the 21st century. This lesson suggests that water conflict resolution in the American West is an exercise in adaptive governance.

The second lesson is that many of the foundational methods and most of the modern approaches to water conflict resolution are designed to bring together a ‘confluence’ of stakeholders and decision-makers. While the confluence analogy helps us understand the evolution of various water conflict resolution methods, it also captures the essence of one of the most consistent and prominent approaches over time – collaborative governance – which may be simply defined as dialogue, deliberation, and decision-making among diverse community interests. A corollary of this second lesson is that most of these collaborative approaches rely on the knowledge, skills, and abilities of a recognized ‘collaborative leader’. As illustrated by elders among Native Americans, church officials in Mormon communities, private landowners and conservationists in the modern era, and others, these are people (and organizations) who have the legitimacy and credibility to bring together disparate interests and seek common ground. In the modern era, it is not uncommon to engage professional mediators, water commissioners, and special masters to help catalyze, convene, and coordinate multi-party dialogues.

This enduring history of collaborative approaches to resolving water conflicts suggests that this approach tends to result in better outcomes (i.e. decisions and solutions that receive broad community support); saves time and money when compared to lobbying, litigation, and other ways of resolving water conflicts; provides the most direct and meaningful form of public participation; effectively integrates social and political values with scientific and technical considerations; and makes implementation easier because the stakeholders have helped shape the solutions.

The third lesson that emerges from this case study is that the American West is embracing the idea of ‘watershed commonwealths’ as originally envisioned by Powell. These commonwealths are defined by the inclusivity of interests, information, and issues. They are distinctive in the frequency with which they originate outside formal governmental structures. The degree to which these types of initiatives are emerging at different spatial scales – from intrastate watershed groups to interstate arrangements to international transboundary initiatives – suggests that the framework for preventing and resolving water conflicts in the American West has organically emerged into a polycentric or nested system of governance that includes both formal and informal methods of water conflict resolution (Ostrom, 2009). The informal approaches tend to supplement and complement the more formal approaches to conflict resolution, thereby increasing the overall effectiveness of the confluence of methods available to prevent and resolve water conflicts.

A corollary to this third lesson is that the emergence of watershed commonwealths is redefining the roles of stakeholders, NGOs, universities, and government agencies (Emerson *et al.*, 2012). As landowners, water users, conservationists, and universities increasingly step forward to catalyze, convene, and coordinate these processes, government officials seem to be increasingly open to redefining their roles, moving away from the unilateral role of decision-maker or the limited role of technical expert to the richer, more useful and stable roles of stakeholders and partners (Wondolleck & Ryan, 1999). Several cautionary notes should be interjected. Effective participation in many of these venues requires substantial time and resources, which occasionally results in under-funded participants leaving the field. Also, many powerful water interests, traditionally more comfortable with backroom deal-making, have retooled to compete successfully in these new venues.

As we look to the future, the fourth and final lesson that emerges from this case study is that the future of water conflict resolution in this particular region of the world is likely to be shaped by an even more intentional focus on collaborative, adaptive, and polycentric systems of governance. Given the increasing uncertainties created by climate change and other social and economic variables, the emerging field of ‘resilience theory’ suggests that we need to focus more on managing the critical functions of ecological systems and less on discrete needs and interests, which tend to come and go. Consistent with the idea of adaptive management and governance, the challenge is to experiment with different policies and practices – in an active learning format – to safeguard the critical functions (Milly *et al.*, 2008).

While this focus on critical functions and systems is compelling, it raises some basic challenges for people seeking to prevent and manage water conflicts. First, how do we reach agreement on – or at least decide – what are the critical functions of major ecological systems? In the Missouri River, for example, some people value the system for its commodity values (hydropower production, irrigation, and municipal and industrial water for growing cities), while others argue that a channelized flow of water without abundant aquatic life is not a river at all! Second, how do we balance the flexible decision-making framework that appears to be essential for resilience theory with the essential goal of conflict resolution systems to provide final, enduring decisions that allow actors to move forward with reasonable certainty about the future? Given that the American West has always relied on some form of collaboration to prevent and resolve water conflicts, it is very likely that this highly adaptable approach to conflict resolution will play an even more important role in the future.

6. Conclusions

The American West provides an extended narrative on how geographic regions defined by scarce, variable water supplies allocate and manage water, prevent and resolve water conflicts, and adapt over time. While this story may inform and invigorate other regions that are increasingly faced with similar imperatives, we hope it also inspires scholars and practitioners from other regions throughout the world to complete similar evaluations and to document and share lessons learned about resolving water conflicts and allocating scarce water resources.

As we seek to transfer lessons from one region to another, this study reinforces the importance of understanding the social and historical context of alternative water conflict resolution methods. Some ideas – such as prior appropriation – may (or may not) be part of the underlying culture of a particular region. The ability to import and adapt any particular method for water conflict resolution ultimately depends on the laws and institutions, cultural fabric, and indigenous traditions of different regions.

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