Climate and Water Governance Chapters

Prof. Elizabeth Burleson

Available at: https://works.bepress.com/elizabeth_burleson/35/
PART V

DISTRIBUTION AND STORAGE ORGANIZATIONS

By Elizabeth Burleson
Chapter 25

BACKGROUND

§ 25.01. General.

§ 25.02. Water Management as a Model for Good Governance.
(a) Optimizing Water Infrastructure.
(b) Desalination and the Energy-Water Nexus.
(c) Subsidies and Other Policy Incentives.
(d) Achieving Good Water Governance.

§ 25.03. Relevance of Drainage and Levee Districts.

§ 25.01 General.

Since ancient times water delivery systems have depended upon collaborative labor, resources, and capital initiatives beyond the capacities of individuals. Today, private or public corporate entities rather than individuals hold most of the water rights in the United States.

Native Americans practiced irrigation farming in the Southwest. Ruins of early canals are still visible in the vicinity of the Gila and Salt Rivers, in what is now Arizona. The canals irrigated land in the Pima and Papagos pueblos in the early part of the nineteenth century. Similarly, in New Mexico the Indians in the Rio Grande Valley irrigated their farms long before the Spaniards came at the end of the fifteenth century.

When the Mormons entered the Salt Lake Valley in Utah in 1847, they created the first large agricultural economy in the West entirely dependent upon artificial irrigation. The Mormons relied upon the efficient diversion of water from canyon

* By Professor Elizabeth Burleson, University of South Dakota School of Law. This chapter is a revision of material taken from the previous editions of this Treatise by Professor John H. Davidson of the University of South Dakota School of Law and Professor Robert W. Swenson of the University of Utah College of Law. Special thanks to John Wallace for his research assistance.


§ 25.01  WATERS AND WATER RIGHTS

streams to valley farmland. The conveyance of water to remote places became an important factor in the development of water law in the West. Water flowed into the private ditch of an individual farmer from branches (laterals) of a main canal. Mountain reservoirs supplied main canals with runoff from mountain streams and springs. In Utah, these distribution systems were generally cooperative community efforts. Initially, individual farmers worked together to build a canal, but over time a system of electing water masters developed. Water masters supervised canal construction/maintenance and distributed water among the various users on a rotating basis. Head gates controlled the amount of water permitted to enter private ditches. Canal networks depended upon gravity.4

Another contribution to the development of American water law was the creation and growth of institutions capable of allocating and delivering water to multiple users. From the early acequias of the Southwest5 to contemporary multi-purpose natural resource management districts, people have struggled with reasonable and equitable water availability. While states have authorized the establishment of both private and public water entities, public institutions have prevailed.6 Thousands of local government water units function distinct from county, municipal, and school district entities.

4 “In the 18th and 19th centuries, Spanish communities continued this tradition by constructing hundreds of community acequias, or irrigation canals, which were maintained and operated under the supervision of an elected mayordomo, or ditch boss. The acequias continue [to be] of importance in the Upper Rio Grande watershed of New Mexico and Colorado today—both in meeting water needs and as a central focus of many rural communities. When the Mormons began their colonization of the West, the church oversaw the development and allocation of water; by 1850, church distribution systems furnished water to over 16,000 acres of land. When the federal government threatened the Mormon hegemony over Utah, the church-dominated legislature responded by passing a law in 1865 permitting a majority of citizens in a county to form an irrigation district. The district, whose officers were elected by the local citizens, could tax property and use the money to build and operate waterworks for the county,” Joseph L. Sax, Barton H. Thompson, Jr., John D. Leshy, & Robert H. Abrams, Legal Control of Water Resources 682–683 (4th ed. 2006).

5 See generally Sara C. Galvan, Wrestling with MUDs to Pin Down the Truth About Special Districts,75 Fordham L. Rev. 3041 (2007), noting that “[f]ederal, state, and local governments encourage and empower special districts—board-run, special purpose local government units that are administratively and fiscally independent from general purpose local governments. Special districts receive incentives, grants, and freedom from limitations (such as limitations on tax and debt) imposed on general purpose local governments. Special districts are treated favorably because they are small in size, which theoretically means they foster democratic participation; are limited in purpose, meaning that states can tailor special districts’ powers to serve specific problems; and are viewed as efficient solutions to specific problems. Though special districts have tripled in number over the last fifty years, the rationale justifying their favorable treatment has not been thoroughly scrutinized.” See also Stephen N. Bretsen and Peter J. Hill, Water Markets as a Tragedy of the Anticommons, 33 Wm. & Mary Envtl. L. & Pol’y Rev. 723 (2009), noting that, “the acequia culture . . . reflects a tradition in which water is viewed as a community resource and decisions about water are made collectively. To support this acequia culture, the New Mexico state legislature granted each acequia the right to veto any proposed transfers of water rights out of its ditch system.” Id. at 771.

6 Sax, Thompson, Leshy and Abrams, Legal Control of Water Resources, supra note 3, at 682, noting that criticism “arose that private water companies were charging exorbitant rates, favoring the more prosperous areas of towns, and failing to reinvest adequate sums in system growth.”
Often these units overlap with or are included in large metropolitan areas. Referred to generically as special purpose districts or special districts, these units are as diverse as the needs and obligations of a modern economy. Special purpose districts are usually motivated by the need to raise up-front construction capital or by the need for some device to compel potential beneficiaries to participate.\(^7\) Public special districts can achieve economies of scale—enabling efficient capital acquisition and water infrastructure maintenance.\(^8\) Public special districts water governance can encompass mandatory dispute resolution processes. This is key where a large number of diverse water users are involved.

Agricultural, industrial, and residential water uses continue to expand. Water institutions play a pivotal role in good governance, especially in arid regions. Reasonable and equitable water resource decision-making is at the core of good governance.

The water districts discussed in this part of the Treatise are located primarily in the western United States where water traditionally has been in short supply and substantial capital investment is required to divert it to distant points. In those areas of the country where water, rather than being in short supply, is in excess, however, farmers and land developers have found it necessary to form private or public organizations in order to construct drainage works. Although dealing with problems of plenty rather than scarcity, drainage districts resemble water districts in many respects and confront many of the same structural and practical difficulties. While all drainage districts depend on enabling legislation for their existence, details vary greatly from state to state. Localized research should begin with the statutes of the particular state.\(^9\)

One of the factors accounting for diversity in public districts is a move from single purpose districts to multi-purpose districts without doing away with the old districts. While almost all drainage districts have authority to construct levees as a part of the drainage system, many states provide for separate levee districts. Apparently the intent of these dual statutory schemes is to focus on a particular entity’s primary activity and structure.

The role of various state agencies with respect to districts is not always clear. Many states, for example, have state water commissions or state engineers, whose primary function, at least in the West, is to allocate usable water. But many state agencies also have a role regarding drainage. Terminology can also be confusing. For instance, many states have used “reclamation” to refer to drainage while some states have used the


\(^8\) “Water organizations reduce the volatility and expense of developing water infrastructure by achieving economies of scale. Governmental water districts can condemn water rights and land, tax local property, and issue tax-exempt bonds,” Sax, Thompson, Leshy and Abrams, \textit{Legal Control of Water Resources} \textit{supra} note 3, at 681.

\(^9\) \textit{See} the individual state surveys \textit{infra} Treatise pt. XI, subpt. B. \textit{See also supra} Treatise § 10.03 (b) and \textit{infra} Treatise § 59.
term in connection with irrigation. Such terms as “reclamation,” “ditches,” and “drains” are often defined by their respective state codes and will occur in the context of drainage districts and water distribution districts.

Good water governance can optimize: physical infrastructure, water innovation/diffusion, and policy. Despite a fixed global supply of water, water management can improve dramatically to narrow the gap between demand and supply. Water organizations can play a role in (1) delivery/storage infrastructure, (2) desalination and the energy-water nexus and (3) innovation initiatives and policy incentives.\(^\text{10}\)

\section*{§ 25.02 Water Management as a Model for Good Governance.}

\textbf{(a) Optimizing Water Infrastructure.}

Water organizations have never had better means at their disposal with which to replace leaking pipes, line canals, recharge aquifers, and implement drip irrigation. Infrastructure challenges remain but are largely fiscal in nature. Just as energy entities struggle to determine who should pay for a smart grid, water organizations must come to terms with the fair balance between investing in storage and delivery infrastructure amidst an array of competing economic concerns. Decades of forestalling water infrastructure maintenance have heightened the need to invest in the water sector.\(^\text{11}\)

This can be done by implementing drip irrigation, replacing leaking pipes, increasing underground reservoir use, and lining clay canals—remaining mindful that doing so will alter return flows upon which many individuals and water entities depend.

Rising costs of sourcing, supplying, and treating water have impacted individuals and water organizations alike, as have more expensive treatment and disposal of wastewater. Agricultural use of water can become more efficient with better irrigation methods. Similarly, residential and industrial use of water can become more efficient by investing in infrastructure that will address extensive leaks in the supply of water. In addition to water efficiency, water must remain within rivers and lakes in sufficient quantity for ecosystem integrity. Facilitating such environmentally sound technology as solar powered drip irrigation can transition water use in a manner that will minimize hardship and maximize water efficiency.\(^\text{12}\)

\textit{The World Water Development Report}\(^\text{10}\) Water: The World’s Most Valuable Stuff, Economist, May 20, 2010, at 1, available at http://www.economist.com/opinion/displaystory.cfm?story_id=16163366&fsrc=rss (noting that solutions include, “the improvement of storage and delivery, by creating underground reservoirs, replacing leaking pipes, lining earth-bottomed canals, irrigating plants at their roots with just the right amount of water, and so on. A second route focuses on making farming less thirsty—for instance by growing newly bred, perhaps genetically modified crops that are drought-resistant or higher-yielding. A third way is to invest in technologies to take the salt out of sea water and thus increase supply of the fresh stuff. The fourth is of a different kind: unleash the market on water-users and let the price mechanism bring supply and demand into balance. And once water is properly priced, trade will encourage well-watered countries to make water-intensive goods, and arid ones to make those that are water-light”). Water: The World’s Most Valuable Stuff, at 1.


\textit{Elizabeth Burleson, Middle Eastern and North African Hydropolitics: From Eddies of Indecision}
notes that “important decisions affecting water management are made outside the water sector and are driven by external, largely unpredictable forces—forces of demography, climate change, the global economy, changing societal values and norms, technological innovation, laws and customs and financial markets. Many of these external drivers are dynamic, and changes are accelerating.”

Challenges include becoming climate resilient both in infrastructure and policy, addressing groundwater quality and quantity, minimizing water use conflicts, and establishing information clearing houses with which to optimize water decision-making.

Security is compromised when boundaries and access to natural resources are disputed. Integrated protection of health and habitat can occur through cooperation. Water management can become a model for good governance.

Integrated water resources management involves considering ecological and socio-economic issues together within an ecosystem approach.

Increasing access to basic water data can facilitate water governance.

---


14 John Leshy, Notes on a Progressive National Water Policy, 3 Harv. L. & Pol’y Rev. 133, 135, 146 (2009) (noting that, “[m]uch of this information can be obtained at reasonable cost through mechanisms such as gauges, meters, and reporting requirements”).

15 Water a Shared Responsibility: The United Nations World Water Development Report 2, 435 (2006) United Nations Educational, Scientific and Cultural Organization (UNESCO) and the United Nations World Water Assessment Programme (WWAP), available at http://www.unesco.org/water/wwap/wwdr2/table_contents.shtml (noting that contracting-out services, operation and management of the water supply, allows the public sector to take advantage of private sector technology and skills, while maintaining the ability to ensure equity of water availability). See also Denise Lach, Helen Ingram, and Steve Rayner, Maintaining the Status Quo: How Institutional Norms and Practices Create Conservative Water Organizations, 83 Tex. L. Rev. 2027, 2032 (2005)(noting that, “[w]ater managers at all levels and in all organizations we interviewed consistently described a common hierarchy of values for managing water resources: reliability, quality, and cost. Reliability for these managers means meeting several, often conflicting, demands: (1) water that is always there when the customer turns on the faucet; (2) water for crops on the most critical days of the growing season; (3) water for fish at the lowest stream flow; (4) water to generate hydroelectricity when demand is at peak; and (5) no substantial loss of life or property in the worst flood”).


(Rev. 2-12/2010 Pub.60748)
§ 25.02(a) WATERS AND WATER RIGHTS

Transitioning to good water governance impacts a wide array of stakeholders that have disparate influences over existing water uses. Given the natural monopoly features of the water sector, governments should assess public-private partnerships with a commitment to equity and meaningful oversight. Lach, Ingram, and Rayner note that adaptive management addresses:

the needs of individuals, not merely supplying water resources. This necessitates new ways of thinking about water, such as differentiating among water qualities, looking for decentralized solutions, engaging stakeholders in identifying needs. . . . Just as biologists and ecologists challenged the norms of narrowly focused organizations, new participants brought different needs, expectations, and worldvies when water resource managers implemented coordination and domestication strategies. These new participants challenged the power of traditional expertise to solve local problems without their explicit involvement. For example, citizens expect decisionmaking processes to be transparent and clear, which necessitates accessible, understandable, and applicable information. Social responses (e.g., values and behaviors) complement the engineering, legal, organizational, and biological expertise common to the strategies for managing water systems described above.

Public participation ranging from information sharing to decision-making remains central to equitable and effective water management.

Sandra Zellmer notes that, “any lasting solution that secures sustainability and intergenerational equity likely requires a large-scale, basin-wide strategy.” She goes


17 Lach, Ingram, and Rayner, supra note 8, at 2049 (2005). See also J.B. Ruhl, Regulation by Adaptive Management—Is It Possible?, 7 Minn. J. L. Sci. & Tech. 21 (2005); Libor Jansky, Dann M. Sklarew, and Juha I. Uitto, Enhancing Public Participation and Governance in Water Resource Management 3 (United Nations University, 2005), noting that, “[g]overnments throughout the world face common problems in addressing the growing water crisis. They struggle to manage water in ways that are efficient, equitable and environmentally sound. Improvements in water efficiency often demand significant capital investment and legal and economic reforms – means generally beyond the capacity of members of the public directly impacted by lack of clean water. Equitable allocation and stewardship of water resources also require detailed understanding of interrelated hydrodynamic, socio-economic and ecological systems. Such knowledge is often sorely lacking among those responsible for water decisions at the local, provincial and national scales.”


19 Zellmer, supra note 12, at 602; see also Eckstein, supra note 12; Stephen C. McCaffrey, A Human

(Rel. 2-12/2010  Pub.60748)
on to advise adaptive, ecologically-resilient management that also achieves sustainability, calling for institutional leadership with clear, ecologically-based standards supported by a secure, non-partisan funding source.\textsuperscript{21} Adaptive management can achieve collaborative and consensus-based decision-making.\textsuperscript{22}

The water governance shift towards integrated water resources management is bringing principles of equitable distribution, efficiency, and environmental sustainability into the limelight.\textsuperscript{23} Water governance involves finding equilibrium between ecosystem integrity and socio-economic uses of water.\textsuperscript{24} Decision-makers include water organizations, civil society, and the private sector.\textsuperscript{25} Achieving good water governance requires balancing conflicting water rights, increasing intersectoral communication, broadly agreeing upon economic incentives, and deciding what constitutes fragmentation of water management and administration versus effective local water governance.\textsuperscript{26} Making such decisions requires mechanisms for public participation and conflict resolution.\textsuperscript{27} Several ingredients of good water governance include: (1) broad participation through the entire decision-making process; (2) transparent flow of information (3) equitable opportunities to increase well-being; (4) accountability from governments, the private sector, and civil society; (5) coherency of water resource measures; (6) responsiveness to changing water conditions and societal factors; (7) integrative approach to water basin management; and (8) ethical principles that resonate with varying societies based upon inclusive dialogues.\textsuperscript{28}

Achieving efficient and equitable water resource allocation requires an understanding of basin riparian use, climatic conditions, and other factors that can be expensive to gather. If water management is transferred from judicial to administrative forums, provisions must be implemented to preclude regulatory capture by powerful stakeholders.\textsuperscript{29} Broad public participation in environmental decision-making can help water measures remain sustainable and equitable.


\textsuperscript{21} Zellmer, supra note 12, at 629, calling upon communities to: “Stop wetlands losses and restore damaged wetlands and floodplains: [p]rioritize areas that are most essential for wildlife reproduction, nesting, and feeding, as well as areas that, if lost, would jeopardize vulnerable human communities and cultural resources (the French Quarter may be one example of the latter point); and, perhaps most of all, [r]ecognize that land and water policies are inextricably linked and plan for both restored flows and open space.”


\textsuperscript{23} Governing Water Wisely for Sustainable Development, supra note 9, at 372.

\textsuperscript{24} Governing Water Wisely for Sustainable Development, supra note 9, at 372.

\textsuperscript{25} Governing Water Wisely for Sustainable Development, supra note 9, at 372.

\textsuperscript{26} Governing Water Wisely for Sustainable Development, supra note 9, at 372.

\textsuperscript{27} Governing Water Wisely for Sustainable Development, supra note 9, at 372.

\textsuperscript{28} Governing Water Wisely for Sustainable Development, supra note 9, at 372.

§ 25.02(b) WATERS AND WATER RIGHTS

(b) Desalination and the Energy-Water Nexus.

Desalination has begun playing an increasingly important role in the water portfolios of water organizations in arid regions. Yet, energy intensive means of increasing water supply need to be assessed. As UNESCO observes, “[l]ooking at energy use and water use simultaneously generates valuable insights that do not arise from separate policy analyses of water and energy issues.”30 Desalination needs more energy than wastewater recycling while “[p]umping systems alone account for 20 percent of the world’s electrical energy demand and range from 25 percent to 50 percent of total energy use in some industrial operations.”31 Water recycling, involving reusing treated wastewater in industry or agriculture, can costs a third less than desalination. Conservation is even less expensive given loss of water due to leaky pipes.32 In the United States, “leaking pipes lose an estimated seven billion gallons of clean drinking water a day” according to the New York Times.33 Beyond clear opportunities to reduce demand for water by facilitating water conservation measures, water organizations have a role to play in supply side decisions that optimize investment in such emerging technologies as desalination.

Desalination currently provides 0.4 percent of the world’s fresh water supply.34 While technological advances in desalination have reduced costs by 90 percent,35 careful siting remains a challenge to avoid concentrations of byproduct brine.36 Irrespective of location, greenhouse gas emissions reduce the attractiveness of desalination but can be ameliorated by use of renewable energy.37 In Australia, Perth’s desalination facility obtains power from a wind farm.38 Such renewably powered desalination plants can

30 Water a Shared Responsibility, supra note 8, at 327.
31 Water a Shared Responsibility, supra note 8, at 327.
34 Water: The World’s Most Valuable Stuff, supra note 3.
36 A wide array of sources contribute to increasingly high salinity levels in ecosystems—a trend that plants and animals find it difficult with which to adapt. See Robert W. Adler, Priceline for Pollution: Auctions to Allocate Public Pollution Control Dollars, 34 Wm. & Mary Envtl. L & Pol’y Rev. 745, 767 (2010), noting that salinity sources can include: agricultural runoff, road construction and development erosion of saline soils reservoir evaporation, point sources of pollution, oil and gas wells, and mining operations.
37 Robin Kundis Craig, Water Supply, Desalination, Climate Change, and Energy Policy, 22 Pac. McGeorge Global Bus. & Dev. L.J. 225 (2010). Professor Craig notes that “water-related energy policy choices . . . extend to the methods of supplying citizens, industry, and agriculture with fresh water. In the U.S. and elsewhere, this water-energy connection is becoming more pointed with the increasing reliance on desalination as a source of freshwater supply.” Id. at 233.
38 Patrick Barta, Salt Free: Amid Water Shortage, Australia Looks to the Sea, Wall St. J., Mar. 11, 2008, at A1 (noting that “Most modern facilities use a process known as reverse osmosis. This involves
substantially minimize the impact of proposed projects.  

By conducting Environmental Impact Assessments, the available alternatives and their costs and benefits can be factored into desalination decision-making. For instance, coastal groundwater extraction can risk salt-water intrusion of aquifers while water transfers from lakes and rivers can significantly alter ecosystems and water cycles. The disadvantages of desalination may be outweighed by the greater negative affects of alternatives. Environmental Impact Assessment processes should facilitate early and genuine public participation. Multi-stakeholder coordination can achieve environmentally sound water and energy policy. Public participation is particularly important in the context of: religious and cultural site impact, existing negative environmental impacts, equity aspects of proposed location, general awareness raising about the pros and cons of the proposed project, and conflict resolution/consensus building among stakeholders. Public participation in implementation can include stakeholder-monitoring committees collaborating with water organizations.

Involving directly and indirectly affected individuals in decision-making facilitates trust and can establish partnerships. It also helps ensure that vital considerations are not bypassed. Providing the public with information and the opportunity to become educated about the proposed project includes a full explanation of environmental, socio-economic, and public health implications. Atmospheric emissions and local air conditions are important considerations when deciding to proceed with desalination.

While renewable energy can mitigate air pollution and climate impacts of desalination, disposal of brine remains a concern. Total loads should be available to the general public and tests should include long-term sediment toxicity evaluations for heavy metals as well as bottom feeding aquatic life that may be disproportionately impacted.  

pushing water under high pressure through porous membranes that filter out the salt. Energy is needed to raise the pressure and then force the water through the membranes.”) Id. See also Cheaper Desalination, Economist, Oct. 29, 2009, at 1, available at http://www.economist.com/sciencetechnology/displaystory.cfm?story_id=14743791&fsrc=rss. See also Tapping the Oceans, Economist, June 5, 2008, at 1, available at http://www.economist.com/science/tq/displaystory.cfm?story_id=11484059&fsrc=RSS.


Desalination, supra note 32, at 4.
41 Desalination, supra note 32, at 4.
42 Desalination, supra note 32, at 4.
44 Desalination, supra note 32, at 12.
45 Desalination, supra note 32, at 22.
46 Desalination, supra note 32, at 22.
47 Desalination, supra note 32, at 22.
48 Desalination, supra note 32, at 29.
49 Desalination, supra note 32, at 29.
§ 25.02(c) WATERS AND WATER RIGHTS

by accumulated chemicals. Increasing access to basic water data can facilitate good water governance. Integrated Water Resources Management involves considering ecological and socio-economic issues together within an ecosystem approach.

(c) Subsidies and Other Policy Incentives.

Nationally, the federal government supports water infrastructure to the tune of roughly three billion dollars annually. Recently, federal stimulus funds have come with encouragement to concentrate on upgrading existing urban infrastructure rather than facilitate further sprawl. The Wall Street Journal notes that:

the Environmental Protection Agency estimated that aging systems in the U.S. will require $277 billion in investments just to upgrade and maintain drinking-water quality over the next 20 years. The power industry is one of many big users; water is critical in hydroelectric dams, cooling processes at fossil-fuel and nuclear-power plants. So is the food industry.

Increased fertilizer use and livestock operations have doubled global nitrogen levels in the environment since the 1940s, altering ecosystems by creating off-shore dead zones, lowering soil fertility, depleting the ozone layer, and contributing to climate volatility. Careful agricultural water policies can alleviate water scarcity as well as reduce surface/groundwater pollution. The Agriculture sector consumes 70 percent of fresh water. Nearly a fifth of the U.S. corn crop is used to produce ethanol, offsetting 1 percent of national petroleum use yet consuming 17,000 gallons of water per gallon

50 Desalination, supra note 32, at 29.
WATER%2Bcomplete_LR.pdf.
52 Alec MacGillis, New EPA Water Infrastructure Policy Seeks to Encourage Smart Growth, Wash. Post, May 5, 2010, at 1, available at http://www.washingtonpost.com/wp-dyn/content/article/2010/05/04/AR2010050404310.html (noting that the "Environmental Protection Agency that instructs states to adopt smart-growth principles in allocating the $3.3 billion in water infrastructure funding that the federal government doles out each year. States, it asserts, should prioritize projects that upgrade the drinking water and wastewater infrastructure in cities over projects intended to serve new developments on the suburban fringe.").
54 “Globally, we have taken over about 26 percent of the planet’s land area (roughly 3.3 billion hectares) for cropland and pasture, replacing a third of temperate and tropical forests and a quarter of natural grasslands. Another 0.5 billion has gone for urban and built-up areas. Habitat loss from the conversion of natural ecosystems is the main reason why other species are being pushed closer to the brink of extinction.” Alex Kirby, Can the Planet Feed Us?, BBC News, Nov. 24, 2004, at 1, available at http://news.bbc.co.uk/1/hi/sci/tech/4038205.stm.
of ethanol. John Leshy notes that:

Subsidies and other features of national agriculture policy generally encourage inefficient water use. So do the subsidies built into the federal reclamation program that delivers artificially cheap water to ten million acres of farmland in the seventeen western states to grow crops that are readily grown in more humid regions of the country and are often subject to production limits in order to keep commodity prices high. Many farmers around the country also benefit from subsidized rates for electricity used to pump water to their fields.

By coordinating water and agricultural laws, lifecycle water costs can be integrated into energy and food policy. Federal subsidies can be coordinated with genuine water conservation measures. For instance, rainwater harvesting can soften the impact of droughts for both rural and urban dwellers. Civil society can call upon governments and donors to facilitate the broad deployment and maintenance of water gathering technology.

Rainwater harvesting provides cost efficient adaptation to variable supplies of water. While rainwater harvesting cannot solve the global water crisis, it can play an important role in water management particularly in water-stressed regions. As a local intervention with local benefits, Chicago’s storm water ordinance calls upon large entities to capture at least the first half-inch of rainfall on-site, while a Tucson

56 Leshy, supra note 7, at 133, 135, 153–154.
57 Leshy, supra note 7, at 133, 135, 154 (noting that FERC’s “authority to order dam removal and restoration in appropriate cases could be clarified, and the Commission could be instructed to carefully consider the climate change and carbon emissions implications of its decisions. Also, the Commission’s processes might be made more efficient and less burdensome on participants.”) Leshy, supra note 7, at 156.
58 Leshy, supra note 7, at 133, 135, 153–154 (noting that, “[t]he federal government should improve its efforts, including working more closely with the states, to ensure a base level of ecological health in every stream”).
59 Leshy, supra note 7, at 133, 135.
60 Leshy, supra note 7, at 133, 135, 155.
61 Leshy, supra note 7, at 133, 135, 155.
62 Edna Sussman, David C. Major, Rachel Deming, Pamela R. Esterman, Aedeb Fadil, Amy Fisher, Fred Fucci, Roberta Gordon, Caroline Harris, J. Kevin Healy, Cullen Howe, Kathy Robb, Jeff Smith, Climate Change Adaptation: Fostering Progress Through Law And Regulation, 18 N.Y.U. Envtl. L.J. 55 (2010). The authors note that “[a]nalysis and legal encouragement of on-site water reuse through regulation and incentives would also further adaptation, although there are public health and environmental issues regarding reuse that need to be investigated further.” Id. at 106. See also Michael Herring & Max Zarate-Bermudez, Response to Climate Change Induced Drought: Assessing Public Health Impacts of Decentralized Water Reuse as a Nonpotable Water Supply 1 (2009).
63 Alexandra Dapolito Dunn, Siting Green Infrastructure: Legal and Policy Solutions to Alleviate Urban Poverty and Promote Healthy Communities, 37 B.C. Envtl. Aff. L. Rev. 41, 46 (2010) (“[r]ather than the traditional approach to stormwater management of capture, convey, and treat, green infrastructure manages rain where it falls, recognizing it as a valuable resource [and] reducing volume to combined sewer and stormwater systems, reducing treatment costs at wastewater treatment plants . . . . decentralized storage and infiltration approaches, including the use of permeable pavement, rain barrels, and cisterns to capture and reuse rainfall”).
64 Patricia E. Salkin, Cooperative Federalism and Climate Change: New Meaning to “Think
ordinance mandates commercial developments to include a rainwater harvesting plan in any site plan applications. Similarities, the Arizona Groundwater Management Act of 1980 has pioneered requirements that developers of new subdivisions assure adequate water before receiving permission to sell lots. John Leshy notes that, “if well-designed, such ‘assured supply laws’ can protect home buyers, improve planning decisions, help protect existing water rights, more fairly allocate the costs of growth between existing and new residents, and encourage water conservation and more efficient uses.” The Southern Nevada Water Authority has become famous for paying private individuals and companies to rip out grass, reducing the use of water for landscaping.

In the agricultural sector, John Leshy reminds us that there is potential to transition to low water-dependent crops given the fact that water-intensive crops tend to be of least commercial value. The agricultural sector can also implement efficiency measures that reduce the need to expend energy to move such large quantities of water.

Water organizations can help implement such demand-side policies as increased efficiency of water use through transfer of sustainable technologies and sensible subsidies. Leshy suggests that the federal government could continue to facilitate

---

68 Leshy, supra note 7, at133, 135, 148.
69 Southern Nevada Water Authority, Water Smart Landscape Rebate, at 1, available at www.snwa.com/html/cons_wsl.html. See also Alexandra Alter, Currents—Environment: Yet Another ‘Footprint’ to Worry About: Water—Taking a Cue from Carbon Tracking, Companies and Conservationists Tally Hidden Sources of Consumption, Wall St. J., Feb. 17, 2009, at 11 (noting that, “[a]lmost all of the water that goes into crops and food production is returned to the water cycle, either as evaporated water or in the form of polluted runoff. But it is temporarily unavailable for other uses, and may not be restored to the same aquifer, lake or river if it comes back as rainfall in another region. That poses problems for water-scarce areas”).
70 Leshy, supra note 7, at133, 135.
71 Leshy, supra note 7, at133, 135, 149.
72 Human Development Report, supra note 9, at 14 (noting that, “[o]ver the period to 2050 the world’s water will have to support the agricultural systems that will feed and create livelihoods for an additional 2.7 billion people”). See also Leshy, supra 7, at133, 135, 154 (noting the obstacles in building new surface storage infrastructure in the United States).
state conservation and efficiency measures via (1) conditioning federal funding for water management on state water reform and (2) a federal grant program that required matching state grants that increased over time. Funds could support increasing capacity to meter water use, price water in a manner that promotes conservation, and ramp up climate resilient, water efficient infrastructure across all sectors. Furthermore, Congress could increase funding to the U.S. Geological Survey with which to map surface/groundwater dynamics.

At the local level, wastewater organizations can play an important role in mitigating greenhouse gas emissions. Municipalities have been investing in methane-to-energy systems to make use of water treatment plant and landfill methane production to offset fossil fuel based power. As part of its Climate Action Plan, Salt Lake City now has the capacity to power over 2500 homes, saving $160,000 per year by using digester gas from wastewater reclamation rather than traditional fossil fuels. This form of community methane capture can complement greenhouse gas mitigation for large energy producers. As limited-purpose institutions, water districts do not necessarily have the authority to regulate greenhouse gases, but within their authority, they may often act in a manner that can be legislative, administrative, or quasi-judicial. Water organizations tasked with a single policy can benefit from public participation to ameliorate the ramifications of water decisions and to manage coordination costs. Genuine climate adaptation collaboration can involve creating a legal framework for the energy-water-climate nexus that coordinates activities—balancing subsidiary and watershed protection. Conscientious public-private cooperation can address agricultural runoff, desalination, reuse, efficiency, and conservation.

Water conservation is a key climate adaptation strategy within the jurisdiction of water organizations and their non-water-related state and non-state counterparts. Voluntary and mandatory conservation measures include maximizing low-flow fixtures and minimizing lawn watering. Vulnerable infrastructure can become less so in the future through engineering codes and policies that take climate change risks into account. Some measures will relate directly to the water sector while others will have substantial impacts upon water delivery. For instance, patchwork progress across the

73 Leshy, supra note 7, at 133, 135, 150.
74 Leshy, supra note 7, at 133, 135, 151.1
75 Salt Lake City Green, Climate Action Plan, available at http://www.slcgov.com/slcgreen. See also Katherine A. Trisolini, All Hands on Deck: Local Governments and the Potential for Bidirectional Climate Change Regulation, 62 Stan. L. Rev. 669, 721 (2010). Trisolini also notes that this technologically proven and quickly accessible source of green power can also provide side benefits by reducing operating costs of cash-strapped local governments.” Id. at 722–723.
76 Jacob E. Gersen, Unbundled Powers, 96 Va. L. Rev. 301, 306 (2010) (noting that “[s]pecial-purpose local government units like school boards wield authority that blends legislative, executive, and often even adjudicative functions, but they exercise power only in a topically limited field like public schools. . . . School districts, sewer districts, park districts, and water districts are but a few examples”).
77 Sussman, et al., supra note 55, at 55.
§ 25.02(c)  WATERS AND WATER RIGHTS

United States is underway to implement feed-in tariffs. In addition to climate mitigation measures, water organizations are likely to be core participants in a wide range of climate adaptation measures. Becoming climate resilient requires a broad understanding of the water-climate-energy nexus. During the 2003 heat wave, France lost up to 15 percent of its nuclear power capacity for over a month since the rivers depended upon for cooling “were too hot and at much lower levels than usual, flowing more slowly, and could not cool the nuclear core when the plants were operating at full capacity. It also lost 20 percent of its hydroelectric generating capacity because of low reservoir levels.”

Weissman and Miller note that water organizations can help coordinate data collection with which to optimize water and energy use. Joint water conservation measures involving energy as well as water providers may benefit from bringing in knowledgeable participants who could identify energy and water win-win scenarios. Collaborative life cycle analysis could assess “mining raw materials, manufacturing, transporting, distributing, using (including operation and maintenance), and handling the end-of-life. Examples of possible inputs are fossil fuels, water, and metals. Examples of outputs include gases, ash, sludge, and scrap metal. [Impacts include] water use, energy use, CO2 emissions, acidification, eutrophication, and human health effects.”

Water organizations can play an integral role in implementing sensible water recycling, conservation, and climate resilient infrastructure including rainwater harvesting capacity. A portfolio approach to water, based on diversified supply, can enhance reliability. A clearinghouse of best practices would help water organizations determine how best to optimize water management. Public participation in California has led to the following balancing between desire to recycle water and caution regarding its quality. A range of stakeholders together drafted the following requirement:

[To limit the application of recycled water to the agronomic needs of the plants receiving irrigation, comply with any salt or nutrient management plan, and adjust the use of fertilizers to reflect nutrient loads in recycled water. Such projects need not undertake any monitoring for potential contamination other than twice-annual monitoring of priority pollutants and annual monitoring for constituents of emerging concern (CECs).]

Constituents of emerging concern include pharmaceuticals and personal care products and exemplify the public health challenges of optimizing recycled water policies. The Food and Drug Administration is reviewing the effects of drugs on the environment, given Environmental Protection Agency and independent scientific

---

78 Sussman, et al., supra note 55, at 149–150.
80 Weissman and Miller, supra note 72, at 260.
81 Weissman and Miller, supra note 72, at 261.
83 Aladjem, supra note 75, at 294.
assessments that certain drugs alter sexual characteristics in fish and other aquatic species. The United States Geological Survey has published a survey of antibiotics, hormones, pain relievers, cough suppressants, disinfectants, and other products found in over 100 waterways downstream from treatment plants and animal feedlots in 30 states. Like desalination, water recycling is emerging as a means by which to increase a given jurisdiction’s water supply. Sharing best practices among water organizations can help optimize public health policies within water delivery programs.

While the challenges are formidable, there is a clear need to transition to climate resilient water policies suited to given regions. Exposure to changing patterns of water availability is impacting economic viability. Robin Craig notes “profound conflicts between appropriators, species, and ecological values.” U.S. Secretary of Energy Steven Chu has warned that climate change will shut down California’s agricultural sector by the end of the century, given dwindling snowpack that quenched the thirst of the country’s leading agricultural economy. California has long struggled to balance growing water demand with diminishing far flung supplies. While 80 percent of Californian water demand is in southern California, 75 percent of the state’s precipitation falls in northern California. The state’s infrastructure for moving water

---


85 Revkin, supra note 77.


87 Robin Kundis Craig, A Comparative Guide to the Western States’ Public Trust Doctrines: Public Values, Private Rights, and the Evolution Toward an Ecological Public Trust, 37 Ecology L. Q. 53 (2010). She notes that “[i]n comparing the public trust doctrines of the western states, moreover, four factors emerge as most important in the evolution of state public trust doctrines. First, the severing of water rights from real property ownership and the riparian rights doctrine freed these states from one set of potentially confining private property rights. Second, subsequent state declarations of public ownership of fresh water allow western states’ public trust doctrines to operate independently of state title to submerged lands and federal pronouncements regarding ‘the’ public trust doctrine. Third, perceptions of shortages of fresh water, submerged lands, and environmental amenities have prompted increased interest, compared to the East, in preserving the public values in these resources. Finally, the willingness of most western states to raise water and other environmental issues to constitutional status and/or to incorporate broad public trust mandates into statutes has encouraged their courts to evolve water-based public trust principles into expanding ecological public trust doctrines.” Id. at 92.

§ 25.02(c) WATERS AND WATER RIGHTS

over the mountains is complex.\textsuperscript{89}

The Sacramento and San Joaquin rivers and their tributaries meet at the Delta south of Sacramento, forming the largest estuary on the west coast, then flow through levees, sloughs, and a myriad of waterways. Before reaching San Francisco’s Golden Gate, much of the water is channeled south via a federal and a state aqueduct. Both bring water to the agricultural powerhouse of the Central Valley and urban powerhouse of Los Angeles. Delta smelt and Chinook salmon have not fared well with water pumping that alters tidal flows, chews up fish, and brings invasive competitors into the ecosystem.\textsuperscript{90}

Judicial limits on water pumping in order to protect endangered and threatened fish\textsuperscript{91} have left water districts with much reduced water availability. In California’s Central Valley, farmers have trimmed trees and used chemical sprays to retard growth. They have also transitioned to such water efficiency measures as drip irrigation, a process where water feeds the roots of crops via perforated hoses as opposed to flooded fields. Farmers have been trading water and using the state water bank. The Westlands Water District\textsuperscript{92} is likely to pay roughly $500 per acre-foot. The Economist notes that “[t]his

\textsuperscript{89} Elizabeth Burleson, Multilateral Climate Change Mitigation, 41 U.S.F. L. Rev. 373, 397 (2007).


\textsuperscript{91} NRDC v. Kempthorne, 506 F. Supp. 2d 322, 328, 365–70 (E.D. Cal. 2007). See further discussion infra Treatise § 39.02(b). See also Robin Kundis Craig, Adapting to Climate Change: the Potential Role of State Common-Law Public Trust Doctrines, 34 Vt. L. Rev. 781(2010); Robin Kundis Craig, “Stationarity is Dead”—Long Live Transformation: Five Principles for Climate Change Adaptation Law, 34 Harv. Envtl. L. Rev. 9, 11–12 (2010): “In May 2007, the U.S. District Court for the Eastern District of California noted that the Delta smelt, ‘a small, slender bodied fish endemic to’ the Sacramento-San Joaquin Delta and already at risk from the joint operations of the federally managed Central Valley Project and California’s State Water Project (‘CVP/SWP’), would likely be put further at risk by climate change-driven decreases in water volume and increases in water temperature in the Delta. Because the U.S. Fish and Wildlife Service (‘FWS’) failed to consider the effects of these changing hydrological conditions on the smelt, its Biological Opinion issued pursuant to the federal Endangered Species Act (‘ESA’) was arbitrary and capricious. The resulting injunction threatened to shut down water delivery to millions of southern Californians—indeed, delivery of water to southern California in summer 2009 (the start of the dry season) was only forty percent of users’ expectations, a result of both continued drought and species considerations. To complicate the water delivery problem still further, in June 2009 the National Marine Fisheries Service (‘NMFS’) concluded that CVP/SWP operations are likely to jeopardize other five species protected under the ESA—the endangered Sacramento River winter-run Chinook salmon, the threatened Central Valley spring-run Chinook salmon, the threatened Central Valley steelhead, the threatened southern distinct population segment of North American green sturgeon, and Southern Resident killer whales—especially considering shifting ecological baselines for these species as a result of climate change.” See generally Southwest Region, Nat’l Marine Fisheries Serv., Nat’l Oceanic & Atmospheric Admin., Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project 575 (2009), available at http://swr.nmfs.noaa.gov/ocap/NMFS_Biological_and_Conference_Opinion_on_the_Long-Term_Operations_of_the_CVP_and_SWP.pdf.

\textsuperscript{92} Lloyd G. Carter, Reaping Riches in a Wretched Region: Subsidized Industrial Farming and Its Link
is no free market. The state sets the price, and since demand even at $500 per acre-foot greatly exceeds supply, water must be rationed. The market is also crimped by a rule that no more than 20% of farmland in any county may lie fallow. Farmers with the capacity to pump groundwater now threaten the structural safety of the aqueducts as the floor of the central valley sinks. Good governance of the Delta is a complex diplomatic challenge to cooperate with over 200 committees, counties, boards, and departments. Efforts to establish a single streamlined authority accompanied by effective water-conservation and bond measures to address aging infrastructure have struggled to gain political ground given the financial crisis and existing farmer/water district stakes. Water organizations can learn from one another regarding sharing water benefits as a means of moving beyond resource conflict. A growing body of literature on greening and brightening the grid has clarified the complexities and interrelationships between energy and water use. Emerging technology is raising new debates regarding the

93 Water in California: Dust to Dust, Economist, Mar 5, 2009, at 1, available at http://www.economist.com/world/unitedstates/displaystory.cfm?story_id=13237162&fsrc=rss (also noting that, “[w]ater from the Sierra Nevada mountains in northern California is pumped out of the Sacramento delta and dumped into a canal that runs 400 miles (640km) through the temperate Central Valley”).

94 Water in California, supra note 86.
95 A. Dan Tarlock, Four Challenges for International Water Law, 23 Tul. Envtl. L. J. 369 (2010). Professor Tarlock notes that the concept of shared benefits “derived from welfare economics which posits that water is simply a valuable, scarce commodity with multiple possible alternative uses. The transcendental objective of efficiency requires that the resource be allocated to the most valuable uses without regard to territorial boundaries. Thus, it may be economically rational for nations to forgo the actual use of wet water in return for the lost opportunity cost development, because benefits can only be shared if there is some degree of cooperation among riparian nations. Three possible efficiency gains have been identified that can flow from benefit sharing: “(1) better ecosystem management, (2) [more efficient] rivers services such as hydroelectric power, and (3) the achievement of regional water security through cost-sharing rather than inefficient duplicate development.” Id. at 397.
coordination of energy and water policy. Natural gas extraction in particular will have broad ramifications for water organizations in many jurisdictions. While drilling chemicals are diluted and injected into gas reservoirs thousands of feet beneath aquifers, EPA testing of residential wells has found 2-BE, a potentially carcinogenic substance that is used as a lubricant in drilling. Residents are finding it difficult to link well contamination to drilling since drilling companies do not have to disclose exactly what chemicals have been used. Generally, they inject a fracking fluid consisting of water, sand, and a myriad of chemicals at high pressure. At given depths, the injection pipe is perforated and the fracking mixture crumbles the substrate to bring natural gas to the surface, leaving 70 percent of the water used below the surface. Increasing the practice of recycling fracking fluid might lower groundwater contamination rates, but at this point insufficient information is in the public domain with which to make informed public health decisions.

Roughly 3,800,000 gallons of water are required to frac a well while a further 80,000 gallons are used to drill a well. Robert Beck suggests the following standards where steam to drive electric turbines. All thermoelectric generators create excess heat and require cooling. Typically, this cooling is evaporative; i.e., evaporating water draws excess heat out of the system. Thermoelectric coal and nuclear plants typically consume 500 gallons of water per MW produced. Similar consumption should be expected by a power tower. However, a water-cooled solar trough plant will likely consume as much as 800 gallons per MW."

99 See, e.g., Phillip E. Norvell, Prelude to the Future of Shale Gas Development: Well Spacing and Integration In for the Fayetteville Shale in Arkansas, 49 Washburn L.J. 457 (2010). See also John C. Ruple and Robert B. Keiter, Water for Commercial Oil Shale Development in Utah: Allocating Scarce Resources and the Search for New Sources of Supply, 30 J. Land Resources & Envtl. L. 95, 143 (2010) (“[c]ommercial oil shale development’s proponents understand the importance of adequate and reliable water supplies and, as seen in Colorado, have staked out claims for significant amounts of water. Aside from these already secured sources of water, development will rely on reallocation of existing water resources. Reallocation, however, means that while some users will win, others will invariably lose as their uses are displaced by more economically profitable uses. Certainty regarding the extent of available supplies and relative priorities is critical in resolving competing claims to scarce water resources—the kinds of claims that will increase in intensity with commercial oil shale development”).

100 Jon Hurdle, Water Worries Threaten U.S. Push For Natural Gas, Oct. 2, 2009, at 1, available at http://planetark.org/enviro-news/item/54924. See also Jon Hurdle, U.S. States Strive to Regulate Shale Gas Industry, Dec. 31, 2009, at 1, available at http://planetark.org/enviro-news/item/56159 (“[s]hale gas is being tapped by advances in horizontal drilling, and by hydraulic fracturing, or ‘fracking,’ a technique that critics say contaminates drinking water with chemicals that can cause cancer and a range of illnesses”). See Owen L. Anderson, Subsurface “Trespass”: A Man’s Subsurface Is Not His Castle, 49 Washburn L.J. 247, 249 (2010), noting that “[f]or instance, when a freshwater supply is being displaced or polluted, or when injected substances leach out of what is supposed to be a confined reservoir, causing serious pollution of the surface or subsurface that cannot otherwise be stopped and remediated, injunctive relief or ejection may be appropriate”; Ruple and Keiter, supra note 92, at 102, noting that, “[i]n light of the growing thirst for water, industry and opponents alike agree that water availability could be key to developing a viable commercial oil shale industry. . . .” and that “[s]torage is key as commercial oil shale development needs water year-around and surface water availability fluctuates seasonally. Permitting and construction of large reservoirs are complex processes that, if poorly planned or managed, could significantly delay large scale water intensive development.” Ruple and Keiter, supra note 92, at 108.

water is used in energy production:

(1) If non-potable water is sufficient and available for the energy operation, use of potable water should be prohibited. (2) When production of an energy form requires substantial amounts of water that are not consumed, every feasible effort must be undertaken to recycle the water. (3) In any real conflict between life-sustenance uses of water and uses for energy production, life sustenance must prevail. (4) If it is feasible to develop an energy form in a location where water is plentiful as contrasted with where water is in short supply, the energy form should be developed where the water is plentiful. If it is not feasible to do so, then STANDARD FIVE should apply. (5) In planning for energies of the future, energy forms that will consume less water, if otherwise feasible, must be favored over those that will consume significantly more water.102

Energy and water are both impacted by demographic, economic, social, and technological developments.103 The pace of greening water law has been affected by the global economic crisis, increased food and energy prices, and climate change.104 These cross cutting issues continue to impact human security and development.105 Balancing equity and economic efficiency is core to effective water decision-making. An ongoing multi-stakeholder commitment to build consensus and coordinate equitable and reasonable water sharing can achieve sustainable development.

Agricultural use of water can become more efficient with better irrigation methods. Similarly, residential and industrial use of water can become more efficient by investing in infrastructure that will address extensive leaks in the supply of water. In addition to water efficiency, water must remain within rivers and lakes in sufficient quantity for ecosystem integrity. Water contamination continues to threaten human health and environmental integrity.

Water organizations can base decisions on the precautionary principal. Rapid population growth, technological innovation, climate volatility, and conflict need to be considered in an integrated manner when developing water policies.106 Achieving good governance and sustainable development requires the political will to take a long term and integrated approach to issues. Water organizations can help implement supply side and demand side water measures in line with evolving scientific understanding of water availability and adaptation innovation.107 Wet regions will experience wetter


103 Water in a Changing World, supra note 6, at xxiii.
104 Water in a Changing World, supra note 6, at v.
105 Water in a Changing World, supra note 6, at vii.
106 Water in a Changing World, supra note 6, at 1.
107 Elizabeth Burleson, Innovation Cooperation: Energy Biosciences and Law, ___ U. Ill. L. Rev. (forthcoming 2011). See also Elizabeth Burleson, Climate Change Consensus: Emerging Interna-
conditions and dry regions will experience drier conditions, according to the Intergovernmental Panel on Climate Change (IPCC). Climate change is altering the scope of global insecurity as water availability becomes less predictable. A sound energy policy that addresses climate change relies upon responsible, widespread transfer and implementation of environmentally sound technology. An effective and equitable response to climate change must address mitigation, adaptation, technology, and finance. NASA Goddard Institute Director Dr. James Hansen notes that in the United States:

[j]the safe level of atmospheric carbon dioxide is no more than 350 ppm (parts per million) and it may be less. Carbon dioxide amount is already 385 ppm and rising about 2 ppm per year.  

Insurance companies have pressed for increased public investment in storm and flood-defense systems and for an increased governmental role as an insurer of last resort. The Human Development Report notes that the U.S. National Flood Insurance Program exposure approaches 1 trillion USD while the Federal Crop Insurance Program exposure is roughly 44 billion USD. Broad understanding of climate risk depends upon an informed general public. The general public’s ability to become informed decision-makers depends upon coverage of the scientific, economic, political, and social implications of climate change.

Water organizations and other local entities have been playing an increasingly important role in addressing climate change. One of the core areas of collaboration involves climate resilient technology innovation and diffusion. Solar or wind powered drip irrigation exemplifies a technology that could be broadly implemented by water organizations.

---


111 Human Development Report, supra note 9, at 79.

112 Human Development Report, supra note 9, at 79.

113 Jacques Steinberg, ABC, CBS and NBC Will Join Forces for a Prime-Time Cancer Fundraiser, N.Y. Times, May 28, 2008, at E3. The media could coordinate climate stabilization efforts in a similar manner as ABC, CBS, and NBC have done by holding a joint benefit for cancer research.

Climate adaptation measures include efforts to obtain more crop per drop by making the agricultural sector less thirsty using genetically modified drought-resistant crops. Genetic modification offers the potential to alleviate hunger, but it also threatens to reduce the availability of safe, quality food, leaving people divided regarding its use.\textsuperscript{115} Debates have also been polarized regarding privatization and marketing of water. John Leshy notes that “privatization seems to have faded as the general public has apparently satisfied itself that more property rights, freer markets, and less government involvement is not the way to deal with water supply issues.”\textsuperscript{116} The Economist notes that “water is difficult to move, difficult to measure, difficult to price and often difficult to charge for, since many people think it should be free. Even in arid market economies where every drop is precious, the price of water seldom reflects scarcity.”\textsuperscript{117} Given the natural monopoly features of the water sector, governments should assess public-private partnerships with a commitment to equity and meaningful oversight.\textsuperscript{118} The Human Development Report notes that, “[t]he debate on privatization has sometimes diverted attention from the pressing issue of public utility reform.”\textsuperscript{119} UNDP calls upon states to provide access to water and to measure success upon performance rather than public/private status.\textsuperscript{120} UNESCO states that,

\begin{quote}
[t]he prioritisation of water uses must be based on participatory mechanisms that enable water conservation and equitable access. Sustainable management projects require public information on the current status and availability of surface and ground water. This information is currently almost non-existent, not systematized and difficult or costly to access. Participatory institutions and societal oversight Legislative norms and water management forms must guarantee that water is available in terms of volume and quality, to ensure the sustainability of ecosystems and human communities and to satisfy their needs. Therefore, systems of governance, both at the basin level and nationally, must be based on existing local water authorities, such as indigenous and rural communities, irrigators’ associations, and other water users.\textsuperscript{121}
\end{quote}

While usufructuary rights to water are allocated to individuals and water organizations,\textsuperscript{122} water ownership should remain in the public domain and water use decisions...

\textsuperscript{115} Burleson, Energy Policy, supra note 107.
\textsuperscript{116} Leshy, supra note 7, at 133, 135, 140. In contrast, Breten and Hill favor interbasin transfers while remaining mindful of junior rights dependent upon irrigation efficiency, which in the western states results in 50 percent of water returning to be usable to downstream junior appropriators relying on the return flow, Stephen N. Breten and Peter J. Hill, Water Markets as a Tragedy of the Anticommons, 33 Wm. & Mary Envtl. L. & Pol’y Rev. 723, 744 (2009) (noting that “[i]n the face of increasing demand for water for urban and environmental uses in the western United States water transfers out of agriculture have been fewer than one would expect based on price differentials, and most of those that have occurred have required extensive negotiations”). Breten and Hill, at 783.
\textsuperscript{117} Water: The World’s Most Valuable Stuff, supra note 3.
\textsuperscript{118} Water a Shared Responsibility, supra note 8, at 10, 418 (noting that contracting-out services, operation and management of the water supply, allows the public sector to take advantage of private sector technology and skills, while maintaining the ability to ensure equity of water availability).
\textsuperscript{119} Human Development Report, supra note 9, at 10.
\textsuperscript{120} Human Development Report, supra note 9, at 10.
\textsuperscript{121} Human Development Report, supra note 9, at 44.
\textsuperscript{122} Leshy, supra note 7, at 133, 135 (noting that, “[m]easuring how water is used is not as...
§ 25.02(c) WATERS AND WATER RIGHTS

should be the outcome of consensus-based actions that balance human and ecosystem integrity in a sustainable manner. Leasing water management contracts to private entities can increase efficiency, but must neither compromise equity nor lose sight of water as a public good.

After decades of focus on flood protection, water supply, agriculture, and navigation, water management has expanded the dam/canalization perspective to an evolving adaptive management water policy. Collaborative governance involves “cooperation, coordination, and communication of various actors.” Alfred Light points out that collaborative governance entities often coexist with the traditional institutions. Informal entities such as the South Florida Ecosystem Restoration Task Force (Task Force) gather local, state, and national water decision-makers every several months that build upon more frequent Working Group meetings. It can be useful to build upon approaches that are working well elsewhere, remaining mindful of regional natural and political variations. The Room for the River’s program offers a model with which water organizations collaborate on climate adaptation while the European Water Framework Directive Article 14 provides a model for public participation in water decision-making. This framework incorporates the Arhus Convention’s call straightforward as it may seem. Water is different from land and from most other commodities in that it is mobile, largely fungible, and reusable. The latter characteristic makes water very different from petroleum, for it means that one person’s ‘waste’ of water often supplies another’s use. Most water used inside a household (perhaps ninety percent) goes through a sewage treatment plant and is thereafter discharged to a water body from which it can be withdrawn and used again. A substantial proportion of the water applied to a garden or field crop runs off into a stream (often called ‘return flow’) or percolates to an underground water body (an aquifer), where it too may be available for some other use.”

123 See, e.g., the adaptive ecosystem management approach under the Comprehensive Everglades Restoration Plan (CERP), Water Resources Act of 2000, Pub. L. No. 106-541, § 601(k)(2)(B), 114 Stat. 2572, 2692. See also Alfred R. Light, The Intergovernmental Relations of Water Policy and Management: Florida-Holland Parallels, 23 Tul. Envtl. L. J. 279, 292 (2010) (noting that the “division of responsibility between the water boards and the national and provincial general governments has evolved and continues to evolve”). Light goes on to explain the independent financing mechanisms of water districts. Id. at 293. See also Alexandra B. Klass, The Frontier of Eminent Domain, 79 U. Colo. L. Rev. 651, 694–696 (2008) (noting an emerging body of literature that states that “governments should move beyond eminent domain reform and adopt a review process for public use decisions similar to that contained in the National Environmental Policy Act (‘NEPA’) or the many state environmental review statutes modeled on NEPA”).

124 Light, supra note 116, at 279, also noting that adaptive management includes “analysis of the ecological characteristics of the different water types, a review of the impacts of human activity on the status of surface waters and groundwater, and an economic analysis of water use.” Light, supra note 116, at 296–297.

125 Light, supra note 116, at 279.


127 Directive 2000/60/EC.

128 Article 14 of Directive 2000/60/EC.
for public access to environmental information and public participation in environmental decision-making.\textsuperscript{129} Water Forums can bring together interested entities and experts. Water organizations can coordinate with river basin associations to make decisions at the most appropriate level.\textsuperscript{130}

(d) Achieving Good Water Governance.

Water organizations are responding to growing water supply and demand challenges by turning to adaptive management—recognizing uncertainty and integrating resource management with evolving aspects of good water governance. Achieving good water governance requires balancing conflicting water rights, increasing intersectoral communication, broadly agreeing upon economic incentives, and deciding what constitutes fragmentation of water management and administration versus effective local water governance.\textsuperscript{131} Making such decisions requires mechanisms for public participation and conflict resolution.\textsuperscript{132}

Lack of water quality and quantity policies can lead to water insecurity for everyone.\textsuperscript{133} There are multiple ways to lower transaction costs and strive for optimal water use.\textsuperscript{134} Gathering stakeholders with federal, state, tribal, and local decision-makers that respect the interests that various non-state actors have can go a long way in reconciling divergent concerns. Citizen water monitoring combined with scientific advisory group involvement can sustain joint fact finding with which trust can be built and better water decisions made.\textsuperscript{135} Water organizations stand at the crossroads of a dynamic water-energy-climate policy debate and have the opportunity to provide leadership in designing and implementing adaptive management.

§ 25.03 Relevance of Drainage and Levee Districts.

This chapter does not deal with the large number of special drainage organizations—public and private—that have played a fundamental role in the development of agriculture in the humid regions of the United States. According to the 1978 Census of Agriculture, there were then 2,254 local governmental units in twenty-nine states classified as “special drainage districts.”\textsuperscript{136} The law that has developed to govern these districts is, however, extensive, and often provides a


\textsuperscript{130} Clark, supra note 22, at 402, further noting that, “as a public good water cannot be left to the vagaries of the market.” Id. at 404.

\textsuperscript{131} Clark, supra note 22, at 404.

\textsuperscript{132} Clark, supra note 22, at 404.

\textsuperscript{133} Clark, supra note 22, at 404.

\textsuperscript{134} Clark, supra note 22, at 404.

\textsuperscript{135} Lawrence Susskind, Alejandro E. Camacho, Todd Schenk, Collaborative Planning and Adaptive Management in Glen Canyon: A Cautionary Tale, 35 Colum. J. Envtl. L. 1, 54 (2010).

\textsuperscript{136} 1978 Census of Agriculture, Drainage of Agricultural Lands, vi–vii.
§ 25.03 WATERS AND WATER RIGHTS

valuable precedent for controversies that arise in or among water supply organizations.\textsuperscript{137}

The water districts discussed in this Part V are located primarily in the western United States where water traditionally has been in short supply and substantial capital investment is required to divert it to distant points for economic use. In those areas of the country where water, rather than being in short supply, is in excess, however, farmers and land developers have found it necessary to form private or public organizations in order to construct drainage works. Although dealing with problems of plenty rather than scarcity, drainage districts resemble water districts in many respects and confront many of the same structural and practical difficulties. The legal issues that are discussed in this part of the publication will also be found in any discussion of drainage districts and their close counterpart, levee districts.

While all drainage districts depend on enabling legislation for their existence, details vary greatly from state to state. Localized research should begin with the statutes of the particular state.\textsuperscript{138} In many states there are several different types of entities involved with drainage; whether one type or another is the most appropriate may well present a difficult choice. For example, while almost all drainage districts have authority to construct levees as a part of the drainage system, many states provide for separate levee districts. Apparently the intent of these dual statutory schemes is to focus on a particular entity’s primary activity and structure. One of the factors accounting for diversity in public districts is a move from single purpose districts to multi-purpose districts without doing away with the old districts.

The role of various state agencies with respect to districts is not always clear. Many states, for example, have state water commissions or state engineers, whose primary function, at least in the West, is to allocate usable water. But many state agencies also have a role regarding drainage.

There may also be problems of terminology, particularly in relation to “reclamation,” “ditches,” and “drains.” “Reclamation” was used frequently to refer primarily to drainage; in many states that usage still prevails. In other states, “reclamation” is used primarily in connection with irrigation and the related necessary drainage works. “Ditches,” “drains,” and related terms are generally defined by their respective state codes and will occur in the context of drainage districts and water distribution districts. Here the distinction is statutory, and statutory definitions must be consulted and relied upon.


\textsuperscript{138} See the individual state surveys infra Treatise pt. XI, subpt. B.