Local Communities, Policy Prescriptions, and Watershed Management in Arizona, California, and Colorado

Edella Schlager
School of Public Administration and Policy
The University of Arizona

William Blomquist
Department of Political Science
Indiana University, Indianapolis

Introduction

For at least the past 25 years, prescriptions of the water policy literature have centered upon two themes. The first theme is that "the watershed" is the appropriate scale for organizing water resource management, because all water sources and uses within a watershed are interrelated. The second is that since watersheds are regions to which political jurisdictions almost never correspond, and watershed-scale decision making structures do not usually exist, they should be created. Watershed-scale decision making organizations would bring together all "stakeholders" and produce integrated watershed management policies that can be implemented efficiently, preferably through some form of watershed authority.

Despite the consistency of the message, the gap between prescription and practice is wide. The number of cases where watershed management has been undertaken in the prescribed fashion is, to state it delicately, small. On the other hand, our observation of water resource management activities in western states has revealed that regional, watershed management *is* in fact developing in several places, but in an altogether different manner. Watershed-scale decision making arrangements and management activities are being assembled in various decentralized and polycentric forms that involve linked and nested relationships among smaller organizations. The emerging result may be characterized as watershed policy making without *a* watershed policy maker.

Why has watershed management not been practiced more widely, particularly through the integrated mechanism of watershed-scale organizations? We use a political science based explanation based on such phenomena as the identification of boundaries, the organization and mobilization of interests, the choice of watershed-scale decision making arrangements, and the relation of watershed management institutions to the rest of the political system. An explanation that incorporates these considerations may be better able to support an understanding of both the relative paucity of integrated watershed management arrangements and the greater frequency of polycentric multi-organizational and intergovernmental alternatives.

In the following section we sketch out the basic arguments of integrated watershed management. Next, we describe watershed management practices in three states – Arizona, California, and Colorado, noting the discrepancy between prescription and practice. We then

critique the underlying assumptions of integrated watershed management and outline a political explanation that accounts for watershed management practices.

The Logic of Integrated Watershed Management

A watershed is a geographic area within which all water resources (rainfall and runoff, surface streams and underground water) drain toward a common point. A watershed typically includes higher and lower elevations forming one or more valleys, such that all water falling or flowing therein moves to the valley(s) and ordinarily toward a river or ocean (although there are some "closed basins" in which water drains toward an interior point such as a salt sink).

Nearly all watersheds contain more than one type of water body or waterway. A typical watershed will include one or more creeks or streams draining the higher elevations, one or more groundwater areas in the valleys and underlying the streams, plus wetlands areas and (depending upon the terrain) ponds or lakes. While each of the water resources within a watershed has its own features and uses (including supporting various habitats), they are related to one another because of their physical situation. The streams drain to a common body of water and probably also replenish the groundwater basins. The aquifers in those groundwater basins may support the base flow of the streams. And other surface water resources such as wetlands and lakes have complex interactions with the streams and aquifers that pass through or beneath them.

The fact that all water resources within a watershed are physically related to one another lends a logic to integrated watershed management—treating resources separately when they have interactive effects produces suboptimal or even undesirable results. Advocates of integrated watershed management point to the U.S. to make their case for the dangers of treating inter-related resources separately.

- The jurisdictional boundaries of governmental units in the United States do not conform with watershed boundaries, contributing to a piecemeal and fragmented approach to managing water resources that are in fact physically interrelated (Gregg et al., 1998; U.S. EPA, 1995: 1-7 and 1-8).
- Governments in the United States have added water programs—supply development, flood control, drainage, drought protection, contamination remediation, contamination prevention, wetlands protection, species preservation, and so on—in an incremental and uncoordinated fashion that does not recognize the connections among these programs and the water problems they are meant to address.
- The lack of coordination among programs has been exacerbated by the fact that the responsibility for their administration and evaluation has been parceled out among multiple agencies and multiple levels of government. Some agencies and their programs have even operated at cross-purposes (Behrman, 1993: 11; U.S. EPA, 1995: iii).
- Still other water problems have remained unaddressed because they do not fit within established programs, and in the absence of such a fit no agency or unit of government is charged with responding to them (Kraft et al., 1999).

- The presence of multiple governmental units and agencies operating within any given watershed, each carrying out some program or policy that affects only one portion of the overall water environment therein, discourages active public participation. Citizens find it difficult to know or learn where to find information, whom to contact or how, and how to participate effectively (Nakamura and Born, 1993: 812).
- The absence of watershed-scale jurisdictions or decision-making institutions, and the lack of coordination among water resource programs, has established and maintained a relatively lax management setting in which agricultural, industrial, and other forms of development have flourished, much to the detriment of the condition of the nation's water resources.

These critiques of the U.S. status quo are followed by recommendations to organize water resources management around whole watersheds rather than the discrete water resources—streams, lakes, aquifers, wetlands—they contain (e.g., Bates et al., 1993; Doppelt et al., 1993; Gregg et al., 1998; Harkins and Baggs, 1987; Hinchcliffe et al., 1998; MacKenzie, 1996; Naiman, 1994; Newsom, 1997; U.S. Coastal America Organization, 1994)[1] The organizational forms that integrated watershed management consist of two prevailing and complementary themes. The first is that watershed-scale institutions will be needed in order to craft and implement watershed policies and programs. The second is that existing jurisdictions—whether defined by functional specialty or geographically at some sub-watershed level—should either be combined or have their resource responsibilities transferred to the watershed level in order to achieve truly integrated management.

The advantages of integrated watershed management are many. Watershed management can restore a vision of ecosystem health that recognizes the connections among the various dimensions of water resources and the life forms those resources support (Walther, 1987: 439). Watershed management holds the potential for drawing together all of the human parties affected by an interconnected water resources system (i.e., the "stakeholders")(U.S. EPA, 1991: 1). And, citizen participation is made easier and more efficacious when there is a watershed management forum or entity pursuing a watershed management program (Nakamura and Born, 1993: 818). Watershed management promotes cooperation among agencies and coordination among programs (U.S. EPA, 1995: 1-5). By adjusting the scale of decision making to the scale of the resource, watershed management can restore rationality to policy making and implementation (Walther, 1987: 440). Science can be more successfully integrated into policy making when policy making is organized at the scale that science recognizes as appropriate. And the number of entities that state and federal policy makers have to deal with and keep track of can be reduced when resource management is organized at the watershed scale (U.S. EPA, 1995: 1-8).

[1] The idea of organizing water resource management on a watershed basis is hardly new. The United States Inland Waterways Commission, appointed in the 1890s to undertake a comprehensive assessment of the nation's interior water resources, "reported to Congress in 1908 that each river system—from its headwaters in the mountains to its mouth at the coast—is an integrated system and must be treated as such" (U.S. EPA, 1995: 1-1). Also, the watershed movement is quite properly seen as one manifestation of a more general movement among environmental protection advocates and agencies, characterized by terms such as "ecosystem management" and "integrated resource management."

Groups from the regional to the international have advocated consolidation of functions at the watershed level. The Western Water Policy Review Advisory Commission's 1998 report, Water in the West: The Challenge for the Next Century, recommends new governmental structures that could reflect the integrated realities of the watershed. Walther (1987: 445) asserted that the success of any integrated resource management project in western Canada depended upon such "major structural changes as transfers of virtually all resource use decisions to its members or cuts in the power of ministries." The Organization for Economic Cooperation and Development has advocated institutional integration, including transfers of power to watershed-scale institutions, as a key step toward integrated river basin management throughout the world (see Newson, 1997: 248).

A considerable amount of activity is currently and recently under way to promote watershed-scale planning groups, councils, inter-agency coordination efforts, and the like. At least some, and arguably most, of this activity has occurred in response to federal and state initiatives. McGinnis (1999: 498) reports that "17 federal resource agencies and state governments officially have embraced some form of watershed approach," and that more than 200 watershed groups have been created in California alone. Kenney (1997) identified 300 watershed groups in the western United States. A survey by Yaffee et al. (1996) found more than 600 ecosystem management projects—many of them watershed projects—in the United States. The Clinton administration's Clean Water Action Plan promotes a watershed approach to water resource management across the executive branch—from EPA to the U.S. Army Corps of Engineers.

Most watershed-scale arrangements established thus far have been on what Nakamura and Born (1993: 808) call the "weaker" end of the spectrum: watershed discussion forums, advisory bodies, inter-agency agreements to collaborate on research, and the like. These typically have little capacity and no authority to take formal decisions, implement activities, or sanction entities within the watershed whose behavior fails to conform to plans. Moreover, many of the watershed councils, basin commissions, and other forms of institutions that now exist or existed in the past were created by an overlying jurisdiction—a state or the national government—were sustained through subsidies from that overlying jurisdiction, and faltered or folded altogether once the mandate and/or subsidies expired.

Nakamura and Born state succinctly what many other observers lament: "The establishment of powerful autonomous entities with comprehensive functional responsibilities and broad implementation powers—transcending existing units of government—tends to be a political rare event in the United States." Only in a handful of instances (they mention Florida's regional water management districts and Nebraska's Natural Resources Districts), have unified entities been created with regional resource management responsibilities *and* been assigned functions that were previously dispersed among other smaller or specialized units (Nakamura and Born, 1993: 808). They further acknowledge that the long-standing American tendency not to create strong regional governance entities is unlikely to be reversed any time soon.

Integrated watershed management has been recommended for as many as 120 years, yet "there is no agreement among policymakers or activists over how to develop and implement watershed-based policies and programs" (McGinnis, 1999: 498). As with ecosystem management generally, there is some agreement upon principles, but little on how to accomplish

it (Milon, Kiker, and Lee: 1998: 37). Efforts to remedy resource problems in a watershed "are not coordinated either by country or by watershed" (Pereira, 1989: xvi). The diversity of programs "has diluted the concept of a watershed approach," (McGinnis, 1999: 498), such that "the meaning of [integrated resource management] remains to be established" (Walther, 1987: 445) and it "is likely to become a myth such as multiple use" (ibid., 439).

Polycentric Watershed Management

Defining watershed management as consisting of a particular type – tightly integrated, and finding few examples of such a type, many analysts conclude that watershed scale management does not occur. Watershed scale management does occur, however, in a substantially different form. In our extensive research in Arizona, California, and Colorado, watershed scale management was the rule, and not the exception. What did such management consist of?

Arizona

Surface water in Arizona is governed by the prior appropriation doctrine and administered by a permitting system. An individual must file an application for a permit to appropriate surface water with the Arizona Department of Water Resources (ADWR). Groundwater is governed under a separate doctrine from that of surface water. Arizona law does not recognize the hydrologic connection between surface and groundwater. Prior to 1980, groundwater in Arizona was governed by the reasonable use doctrine. Landholders above a groundwater aquifer had the right to pump as much water from the aquifer as they want as long as they put it to reasonable use. Since such a doctrine establishes no pumping limits, landholders above an aquifer can easily find themselves in a "tragedy of the commons" situation.

In 1980, the Arizona legislature passed a groundwater management act. The act is a complex amalgamation of rules, regulations, and organizational structures, reflecting the many compromises reached in obtaining its passage. First, its provisions apply only within state-designated Active Management Areas (AMAs). The traditional reasonable use doctrine still applies outside those areas. Four AMAs were identified in the act, and a fifth was added later. The AMAs cover the most populous parts of the state, which were also experiencing the most severe groundwater overdrafts.

Instead of authorizing local control of groundwater management, as the municipalities wanted, the act created the Arizona Department of Water Resources (ADWR) and gave it and its director extensive authority to implement and administer the act, including the development of more specific guidelines. The ADWR director—appointed by the governor—is often referred to as Arizona's "water czar," and has almost complete discretion in devising groundwater management practices for each AMA (Leshy and Belanger, 1988). In a concession to municipal interest, however, each AMA has its own local director and a local citizen advisory board.

The act and its implementation have established a system of quantified groundwater use rights that protects existing pumpers. One of the most striking aspects of the AGMA was that it placed no direct limits on the amount of groundwater that may be pumped by the most rapidly expanding water users--municipalities. The legislation directed the ADWR to develop an assured

water supply plan that would limit, and even wean, municipalities and developers off of mined groundwater. Eventually, all demand for water will in some manner be met through renewable supplies.

To assist municipalities and developers in meeting the assured water supply rules, attempts were made to create regional replenishment or augmentation districts that would develop portfolios of renewable water supplies, largely recharged CAP water, that water purveyors could purchase. Each of these attempts faltered under local politics. However, two large-scale water banks have been created in Arizona. In 1993, the Central Arizona Groundwater Replenishment District was created as a subdivision of the Central Arizona Water Conservation District, which owns and operates the Central Arizona Project. The Groundwater Replenishment District was given the authority to engage in groundwater recharge projects and contract with water purveyors seeking or possessing an assured water supply certificate to provide them with recharge credits as a means of demonstrating a 100-year supply of water. The district was a critical mechanism for allowing developers access to renewable sources of water for their developments.

In 1996, the legislature created the Arizona Water Banking Authority (ABWA). Its Arizona Water Bank contracts with Arizona organizations that have the ability and capacity to engage in recharge projects to store surplus CAP water. Given demand expectations for Colorado River water over the next 50 years, even CAP water is expected to fall short beginning around 2025 (Metzler and Carr 1998). The Arizona Water Banking Authority (AWBA) is the state's institutional mechanism for ensuring that Arizona's current excess CAP supplies are stored and will be available when the state begins to face those shortages.

Unlike California and Colorado, Arizona has centralized the *administration* of all types of water and water projects in large and powerful state-created organizations–the Arizona Department of Water Resources, the Arizona Water Banking Authority, and the Central Arizona Water Conservation District. The ability of local entities to acquire, use, and develop water is carefully overseen by state centered agencies.

While the administration of state water laws and regulations is more centralized relative to other states, the provision, production and management of water in basins and watersheds occurs through the activities of multiple, overlapping organizations. Municipal and residential water supplies are provided through water districts, municipal water utilities, and private companies. Farmers rely primarily on irrigation districts for their water. Municipal and rural water providers have developed their own sources of water, such as wells, and they also contract with larger, regional water projects for their water. For instance, water providers in the Phoenix metropolitan area use groundwater, Salt River Project water, and Central Arizona Project water. Even though Arizonans are proud of the strong state agencies they have created to devise and administer water laws and water, Arizonans have not created watershed managers.

<u>California</u>

In California, the doctrine of prior appropriation is followed with respect to surface water supplies and their uses. Surface water users apply to the State Water Resources Control Board to receive permits to divert and use specific quantities of water per year.

There are four notable exceptions or limitations in California's implementation of the prior appropriation system. First and most important, three of the largest surface water systems in California—the Sacramento, San Joaquin, and Colorado rivers—have been allocated in a substantially different way. Flow in each of those rivers is controlled by large-scale water projects, and the operators of those projects deliver water to contractors in their service areas.

The second and third limitations on the appropriative rights system in California are the public trust doctrine and the common law of public nuisance. Both have been employed against the appropriation by the Los Angeles Department of Water and Power (LADWP) of water from the Owens Valley and from streams feeding Mono Lake.

The fourth notable exception to the appropriative rights system is the often-litigated but rarely-recognized doctrine of pueblo water rights. Settlements established as pueblos during Spanish colonization of California were granted under Spanish law a right to use as much water as needed for the residents of the pueblo. A pueblo water right (thus far recognized only for the cities of Los Angeles, San Diego, and San Francisco as successors to their respective pueblos or presidios) is superior to any and all appropriative rights claims, and may even be recognized as dedicating the complete flow of a stream (e.g., the Los Angeles River) to the pueblo successor.

Rights to the use of underground water supplies in California are recognized and allocated by a multi-faceted (and sometimes overlapping) set of rules that can most optimistically or charitably be called complex. For groundwater, all of the following possibilities for acquiring and defending rights of use apply in California.

1) Overlying landowners enjoy non-quantified rights to pump groundwater for beneficial use on their overlying land,. Shortages arising from the "commons" problem this system encourages are allocated according to the doctrine of correlative rights, which means that overlying owners are entitled to a proportion of the aquifer's sustainable yield that corresponds to their proportions of the overlying land.
2) If overlying owners' uses do not exhaust the aquifer's sustainable yield, there remains some amount of "surplus" groundwater left for capture. Individuals may "appropriate" this surplus groundwater by pumping it and delivering it to non-overlying lands or to lands they do not own (municipalities that supply water to their residents are typical appropriators in this regard).
3) Overlying owners and senior appropriators cannot sleep on their rights, however, because an appropriation of non-surplus groundwater exercised notoriously and continuously without objection during a period of shortage may ripen into a superior prescriptive right.
4) Any individual or organization that imports water into a watershed for use upon the land also has a right to pump and use the return flows of their imports.
5) Pumping rights may also be (and in several cases have been) acquired by adjudication. These quantified rights may derive from a stipulation among the parties, or from a determination by the court based on any combination of the above doctrines.

The State Water Resources Control Board (which includes a system of Regional Water Quality Control Boards) and the California Department of Water Resources are the two prominent state agencies concerned with the allocation and management of water *supplies*. In addition to operating the State Water Project, the Department of Water Resources also conducts studies of state water conditions and the hydrogeologic properties of state water resources.

All other water supply management organizations in California are local. California contains an immense number of water districts and other local water supply agencies. An alphabetical listing of them published periodically by the Department of Water Resources runs to dozens of pages.

Many water districts in California were created under general-purpose enabling legislation, but there are lots of general-purpose enabling acts. Each such act creates a class of water districts, with a different mix of authority and responsibilities from the class of districts created under some other act. These enabling acts have been the basis for county water districts, irrigation districts, California water districts, municipal water districts, water storage districts, water replenishment districts, community service districts, groundwater management agencies. Some of these agencies have powers that would be compatible with developing and implementing conjunctive management programs; others do not.

California also features many special-act districts, created by their own legislation that is none of the above. Examples include the Metropolitan Water District of Southern California, the San Diego County Water Authority, the Orange County Water District, the Antelope Valley-East Kern Water Agency, and the Mojave Water Agency. Most of these were created to authorize surface water projects or to establish local or regional contracting agencies for one of the large-scale water projects in the state.

Many municipalities have their own water utilities, some of which become extensively engaged in water management activities as well (e.g., Los Angeles Dept of Water and Power, San Francisco Water Department, San Diego Utilities). Many of these were established to develop surface water supplies for municipal distribution, although others (depending upon their location) have relied on groundwater or a mix of both surface and underground supplies. Some communities are still served by private water companies, although private water purveyors are much less numerous than in the heyday of mutual water companies organized to construct small-scale projects to supply water for irrigation uses.

Watershed management in California occurs within the context of a complex amalgamation of state, regional, and local administrative agencies and water providers and producers. For instance, the San Gabriel River watershed in Los Angeles County, California, might fit the description of "watershed management without a manager." It is an example of a regional management program achieved entirely through interorganizational and intergovernmental arrangements.

In response to the water resource challenges they faced, water users in the San Gabriel River watershed developed a set of tightly interrelated institutional arrangements. Those arrangements include:

- local water supply and distribution, conducted primarily by municipalities but also some small water districts and private water companies;
- imported water supply and distribution, performed by a regional water importer that supplies water to five municipal water districts and six member municipalities within the watershed, while one other municipal water district contracts directly with the state for imported water;
- supplies water to five municipal water districts and six member municipalities within the watershed, while one other municipal water district contracts directly with the state for imported water;
- water user associations that provide regular communication opportunities;
- court judgments limiting groundwater withdrawals and obligating the upper area of the watershed to guarantee an average annual supply to the lower area;
- court-appointed watermasters that monitor compliance with the judgments, including a three-member watermaster composed of upper and lower area representatives to monitor the river judgment;
- a replenishment district that finances and oversee artificial recharge and sea-water projects for the two lower area groundwater basins;
- multi-member boards in the two upper area groundwater basins that combine the watermaster function with the conjunctive management of those basins for water supply and storage.
- contracts with the operator of the flood control, water replenishment, and sea-water barrier facilities; and
- contracts with a supplier of reclaimed water for use in replenishment projects.

Despite the complexity of the physical system and the absence of "a manager," there is water resource management in the San Gabriel River watershed. The system of interorganizational and intergovernmental arrangements has demonstrated high levels of effectiveness, equity, and adaptability with low administrative and operating costs (Blomquist, 1992).

Colorado

In terms of institutional arrangements governing water, Colorado is at the opposite end of the spectrum from Arizona. Although both states employ the prior appropriation system (as does California with respect to surface water), Colorado water law is largely defined and administered at the local level within water districts, water courts, and groundwater districts. To be sure, Colorado uses state-wide entities, such as the State Engineer, and the Supreme Court, but these entities primarily provide administrative support and oversight of activities largely undertaken at the local level.

In Colorado, the prior appropriation doctrine applies to both surface water and tributary groundwater. The doctrine is administered through the coordinated efforts of water appropriators, water courts, water commissioners, and the State Engineer's Office. Appropriation rights are defined and enforced by water appropriators within the context of water courts. The water court decision making process is based on consensus. If a consensus is not achieved, the ruling by the water judge may be appealed to the Colorado Supreme Court (Vranesh 1987).

Besides the water court, the only other watershed level decisionmaker is the State Engineer, who is assisted by a division engineer in each watershed. In turn, a water commissioner in each water district assists each division engineer. The water commissioners, the division engineers, and the State Engineer primarily act as coordinators. Water commissioners measure and monitor water appropriations. At the direction of the division engineer they shutdown junior appropriators so as to satisfy the water rights of senior appropriators. The division engineers maintain and update lists of appropriation rights and priorities in each division. They determine the accuracy of statements made in water applications and protests. They measure water flows, determine who is in priority, and order junior appropriators shutdown. They inspect and monitor diversion works, reservoirs, and dams, ensuring safety and accurate measurement of diversions (Vranesh 1987:509).

In Colorado groundwater law and administration, the "location of the well, the waters which it captures, and the uses to be made of the water all result in different rules" (Fischer and Ray, 1978: 47). Designated groundwater basins are basins whose water is not of a natural surface stream or whose movement toward a stream is so slow that it is as if it were not part of the stream. Such basins are governed under the Ground Water Management Act of 1965. That act established the priority doctrine with respect to, and among, uses of groundwater in the designated basins and granted the Ground Water Commission broad powers to regulate and manage supply and demand. "The Commission will ordinarily attempt to manage the pumping so that recharges will be sufficient to allow all permitted wells to obtain water. However, in times of great shortage, some of the later wells may have to cease pumping in order to allow the ones with an earlier date of appropriation to continue" (Fischer and Ray, 1978: 57).

Where pumpers would prefer local control to state regulation of the basin, they may form a groundwater management district, governed by a board of directors composed of basin residents, and funded by property taxes within the district. Such a board assumes essentially the same powers and functions within the basin as the Ground Water Commission would have exercised.

Another set of rules applies to wells pulling groundwater that is not tributary to a natural surface stream, i.e., *nontributary groundwater*. "These are waters held in natural basins underground from which they cannot escape" (Fischer and Ray, 1978: 48). These basins and wells are administered by the State Engineer's Office. In nontributary (non-designated) groundwater areas, the State Engineer reviews new permit applications to make a judgment on the following considerations: (a) the extent of the supply in the basin, (b) the effect on that supply of existing wells, and (c) the goal of making the existing water supply last for 100 years. In addition, permits will be granted only for groundwater use on overlying lands within the basin (Fischer and Ray, 1978: 57).

Even though the division and State Engineers and the water courts operate at the watershed level, neither arrangement qualifies as a watershed manager. The water courts are limited to hearing only those cases brought before them by water appropriators. The courts decree rights on a case by case basis, and rarely does a case raise watershed level issues. Furthermore, water courts are limited in the types of cases that they may adjudicate. They exercise authority only over water allocation. While allocation is critical, particularly in the West where water is scarce, it is just one of many issues that constitute watershed level management. The state and division

engineers are limited in their authority too. They administer water rights, and they ensure their coordination, but they do not define them.

Water appropriators rely on multiple types of organizations to provide, produce, and deliver water. The appropriators who played the central role in devising the state's water administrative machinery and who rely most heavily on water native to the South Platte River and Arkansas River watersheds (the two most heavily used and populated watersheds in Colorado) are irrigators. Raising crops in eastern Colorado requires the artificial application of water to the land. Irrigators rely on combinations of companies, districts, and associations to marshal the resources and expertise to build, maintain, and operate reservoirs, ditches, canals, laterals, and headgates.

One relatively complex combination is that of a ditch company, a special district, and lateral associations. The ditch company owns rights to decreed amounts of surface water and a canal for delivering the water. Farmers purchase shares in the company, which entitle them to a proportion of the company's water. An irrigation district, which is often formed by the same farmers who own the ditch company, owns and operates a storage reservoir, the ditches and diversion works that transport the water from the river to the reservior, and from the reservoir to the ditch company's canal, and the rights to decreed amounts of river water to be used to fill the district's reservoirs. The irrigation district may also contract for water developed through a conservancy district project. Conservancy Districts plan, construct, and operate large water projects. Their purpose is to allow the citizens of Colorado to make more complete use of the waters of the state (Radosevich et al. 1976). For instance, the Northern Colorado Water Conservancy District operates the Colorado-Big Thompson project, which delivers water from the Colorado River watershed to the South Platte River watershed.

Farmers whose lands lie within the irrigation district's boundaries receive water based on the amount of land they own. These same farmers formed lateral associations to build and maintain the laterals that are used to deliver water to individual fields. Often several lateral associations will be formed within the boundaries of a single district and an association of associations will be formed to represent all laterals before the district.

Most municipalities in the South Platte and Arkansas Watersheds rely heavily for their water supplies on waters transported over the Rocky Mountains from the Colorado River Watershed. Numerous transmountain water projects have been developed singly and jointly by the cities of the Denver Metropolitan region, such as the Denver Water Board in the South Platte Basin, and by the cities of Colorado Springs and Pueblo in the Arkansas Basin. For instance, Colorado Springs has developed several projects alone and with others that produce close to 180,000 acre feet of water annually (Abbott 1983:11). Very little of the water is native to the Arkansas Basin. The water originates from several different watersheds ranging from 30 miles to 160 miles from the city. Colorado Springs has developed the water in its closest watersheds, such as Pikes Peak, but has worked with different cities and with the Southeastern Colorado Water Conservancy District to develop water in the Colorado River Watershed.

Water appropriators in both the South Platte and Arkansas watersheds are tied together through their mutual dependence on different sources of water and through their collaborative efforts to develop and allocate that water. Appropriators exchange different sources of water with

one another. For instance, irrigation systems will exchange their Colorado-Big Thompson Project water with cities for South Platte River water. In the exchange, cities receive a higher quality of water and irrigation systems receive a larger volume of water that is of satisfactory quality for irrigation. Appropriators collaborate on different water projects. Both watersheds are laced with reservoirs, dams, and aqueducts, pumping stations, pipelines, ditches and canals that extend into neighboring watersheds. And, appropriators fight and contest each other's actions in water court, protecting their current water rights and attempting to gain advantage in developing future rights.

Water appropriators and public officials alike are actively engaged in watershed management in the Arizona, California, and Colorado. However, such watershed management occurs in a bottom up fashion. Local appropriators rely on state laws to craft organizations to meet their needs or to address pressing problems. These organizations often coordinate, sometimes with the assistance of state officials, to address regional opportunities and problems. In no instance, has a state, or have appropriators, created a watershed manager to govern a watershed.

The Politics of Integrated Watershed Management

The gap between prescription and practice in integrated watershed management is vast. Those who support integrated management suspect that politics has something to do with it. The tone of frustration with political variables and considerations can be heard clearly in some of the assessments composed by hydrologists, engineers, conservation biologists, and other professionals. Watershed management initiatives "face numerous obstacles, more social than hydrologic" (Kraft et al., 1999: 10). The key variable in their success may be "the degree of political commitment to the objectives by those who have authority to act. Regrettably, science can offer no help in this problem" (Pereira, 1989: 54). Political considerations are seen as flies in the ointment of public policy, which could otherwise balm the ailments of society.

Instead of treating politics as the barrier to rational and comprehensive management of watersheds, politics, or at least explanations grounded in politics, allow us to point out the dangers of ignoring political considerations in proposing management reforms, and to account for the polycentric forms of watershed management that occurs in Arizona, Colorado, and California. In providing both a political critique and a political explanation, we focus on three fundamental assumptions undergirding the integrated watershed management approach -- that watershed boundaries are relatively easy to define and have meaning independent of humans, that it is possible to devise a single watershed level decision making process that will be both effective and fair, and that a single watershed level decision maker can effectively engage in a wide range of activities that will account for and effectively integrate the human uses of a watershed.

Boundaries

One of the attractions of integrated watershed management is that watersheds appear to be well bounded. Watershed boundaries are preferable because they are "natural" (e.g., Pereira, 1989: 9). Their existence as natural boundaries removes them from the arbitrariness and mutability of other, human-created borders. McGinnis reviews

watershed definitions, from EPA's to Webster's, that characterize watersheds "as hydrologic entities, which continue to exist even if stripped clean of biota, soil, or culture" (1999: 497).

The simplicity and certainty of a watershed-based approach in practice, however, proves elusive. Newson deflates the classic, crumpled-balloon catchment image as a product of "the tidy-minded, rather simplistic positivism of the river engineer," who sees the watershed primarily as a series of physical problems to be solved (1997: xxvi). He suggests that when we consider "at another extreme the Amazon river basin [which] has a basin area of 5 [million square kilometers] and is in desperate need of efficient management under changing political and environmental circumstances, the hydrologist's simplicity of concept may be dangerously illusory" (1997: xxiv).

This is one problem that arises in defining the watershed. The simple image of the watershed has made it easier to promote integrated watershed management, but "out there" in the "real world," individuals find an enormous range between extremes. On the same page of a document where EPA suggests that a watershed approach might simplify resource management, the agency acknowledges "watersheds occur on a range of scales from the subnational or regional (e.g., the Mississippi watershed) down to local scale (e.g., the watershed of a small creek)" (U.S. EPA, 1995: 1-8). Furthermore, most watersheds are nested within others. The EPA document acknowledges this, too: "In an average state, there may be ten or more major watersheds containing several hundred moderately-sized watersheds, and thousands of still-smaller watersheds within these" (1995: 1-8).

A second problem is that, once human beings have arrived on the scene and begun interacting with natural phenomena, watershed boundaries are not quite so neatly defined entirely by "natural" markers. The southwestern United States exemplifies this dynamic as well as any place on the planet, since human beings there have been impounding watercourses, transporting water across significant distances, and otherwise altering nature's designs for hundreds of years. For instance, in Arizona, California, and Colorado, waters from the Colorado River have been introduced into other watersheds far from the Colorado River's drainage basin.

Once these characteristics of watersheds—their tremendous diversity of size, their nested organization, and the prospect that human actions or other events can alter watershed boundaries—are combined, a fairly obvious question is begged. Around which watershed do advocates of integrated watershed management recommend that resource management activities be organized?

In place of a definition of the type of watershed to use, EPA offers this eminently reasonable-sounding advice:

> Some issues, such as controlling nutrient loading to small lakes or restoring headwaters riparian habitat quality, are best addressed at the local watershed level. Other issues may be best addressed at the basin [i.e., major watershed] level, such as phosphate detergent bans, wetlands mitigation banking, or nutrient trading. Still other activities and solutions are best implemented at the state level,

including policies on toxics control or the operation of permit programs (U.S. EPA, 1995: 1-8).

Such sensible recommendations can hardly be disputed in and of themselves. Still, one could be excused for wondering how this description relates back to the goals that drew EPA and others to the watershed management approach in the first place—namely, recognizing the interrelatedness of resources within a watershed and overcoming the fragmentation of policy responsibilities among a variety of jurisdictions.

The definition of a watershed and the selection of boundaries are matters of *choice*. If we abandon the view of watersheds as purely hydrologic phenomena defined in purely hydrologic terms, that exist even when "stripped bare of biota, soil, or culture,"[2] then for each watershed management effort some element of choice must be exercised over what we mean by the watershed. And as soon as the matter of choice is present, there is a role for politics—which, among other things, is about who decides and how and with what effects (Lasswell 1936).[3]

Among the watersheds that we have studied, water appropriators have defined multiple and overlapping boundaries, these boundaries sometimes correspond to a definition of a watershed and sometimes not, and they most certainly change over time as people grapple with different problems and changing circumstances. For instance, shortly after Colorado became a state in 1876, water districts were created and each district was assigned a water commissioner. The role of the water commissioner was to record the water rights of each appropriator in the district, and to see that those rights were satisfied according to the prior appropriation doctrine. In other words, the water commissioner implemented the prior appropriation doctrine on behalf of the district's water appropriators.

---

[2] Freemuth counters with an observation from western laureate Wallace Stegner, who "once reminded us: a place is nothing in itself. It has no meaning, it can hardly be said to exist, except in terms of human perception, use and response" (2000: 125).

[3] The few political scientists who have contributed to the watershed literature have made this point also. Woolley and McGinnis (1999: 591) have stated: "Each [watershed] group struggles with a basic political issue—defining boundaries and planning issues. The benefits of the watershed focus… do not include the elimination of conflict and contention. Watershed planning, therefore, is always a scientific *and* a political activity." Freemuth (2000: 125) adds, "We must pay close attention to the definition of the problem we are trying to solve…. and defining a problem is a political act." Nevertheless, some advocates of integrated watershed management attempt to avoid politics by resting their support for watershed level decision making on appeals to science. Advocates of integrated watershed management often portray the watershed focus as a means of reconciling policy to science. Freemuth (2000: 125) has raised the follow-up question: which science? Each science has an underlying set of values. Forestry, horticulture, hydraulics, and engineering share a fundamental premise that emphasizes the control of nature for the sake of the public good. Resources are developed in order to provide goods and services that are desired or needed by large numbers of people. By contrast, the sciences of ecology and conservation biology share a premise that emphasizes natural resources as part of the earth, to be protected from people. The watershed management movement may be a way of reconciling policy to science, or it may be a political act of shifting the policy arena to one that is dominated by a different set of sciences.

Each district encompassed an area and a number of appropriators that a single commissioner could serve. Yet, conflict emerged between districts and district commissioners. Multiple districts shared a single stream or river. A commissioner in one district could not order appropriators in another district to stop diverting water, even if such action was necessary in order to satisfy the water rights of senior appropriators. In 188x, the state legislator laid a watershed boundary over water districts and created the position of watershed engineer. The commissioners were ordered to follow the directives of the engineer who was authorized to coordinate the prior appropriation doctrine across districts in a single watershed. Commissioners, whose first responsibility was to the appropriators in their own districts, would occasionally refuse to recognize the authority of the engineer and disobey his orders. Water court records are littered with cases in which judges counseled commissioners not to overstep their duties.

Coloradans are currently struggling with redefining watershed boundaries to not only encompass surface water but groundwater as well. As farmers in the eastern plains of Colorado switched to wells in the face of drought in the 1950s, the hydrologic connection between ground and surface water became clear. Water tables dropped and stream flows declined. Surface water rights holders demanded that well pumpers not be allowed to take water that rightfully belonged to them. Yet, shutting down well pumping meant foreclosing access to millions of acre feet of water stored in the groundwater basins. How to allow for the use of a major source of water while still following the prior appropriation doctrine is a difficult issue not yet satisfactorily resolved (Schlager 1999).

Boundaries among water appropriators in California change as appropriators develop new sources of water. A sound case can be made for the contention that the Santa Ana River watershed in southern California has been expanded including the adjacent San Jacinto Basin area, which had been previously thought to be a separate, closed watershed. The change of definition originated in political and economic reasons. The Eastern Municipal Water District of Riverside County (EMWD)—which overlies most of the San Jacinto Basin—became interested in joining the Santa Ana Watershed Project Authority (SAWPA) in order to gain access to SAWPA's regional waste pipeline that transports certain municipal and industrial waste products past the river to a treatment plant near the Pacific Ocean. Since then, additional SAWPA projects have extended and connected facilities in the San Jacinto Basin to facilities elsewhere in the Santa Ana River watershed. Lake Elsinore, once a terminal water reservoir in EMWD's area, now receives more treated water from within the San Jacinto region and occasionally spills into a creek that flows to tributaries of the Santa Ana River.

Nearby, in northern San Diego County and western Riverside County, local water districts and the U.S. Marine Corps base at Camp Pendleton have collaborated on a program that uses treated water that originates from Murrieta Creek (which flows inland and expires in the desert) to recharge groundwater basins and supplement surface flows in the upper reaches of the Santa Margarita River (which flows out to the Pacific Ocean). In both of these cases, human actions have created water resource connections between basins that were, as recently as 20 years ago, not regarded as parts of the same watershed.

Boundaries are multiple, overlapping, and often contested because people experience and attempt to deal with a host of problems and opportunities that vary in scale from the local to the

regional. Drawing boundaries is the first step in determining who decides and how and with what effects. Different boundaries imply different decision makers and different effects.

Just as local communities and jurisdictions acting alone often cannot effectively deal with problems that extend beyond their borders, centralizing watershed decision making at the watershed level always bears the risk of overlooking or undervaluing local impacts. Ingram et al. (1984: 326) cautioned, "It is important to look at consequences from a particularized or localized perspective as well as basinwide. Despite the fact that physical scientists describe river basins as general, interconnected systems, the experience of impacts is often discrete and localized." In localized settings, decisions about water resources are also decisions about the nature, strength, and future of communities. "Water still symbolizes such values as opportunity, security and self-determination…. Control over it signals social organization and political power…. Strong communities are able to hold on to their water and put it to work. Communities that lose control over water probably will fail in trying to control much else of importance." (Ingram, 1990: 5).

Centering authority at the watershed level, as advocates of integrated watershed management would like means that non-local communities of interest will be involved in decision making about a particular place. As Bates et al. (1993) recount:

> As illustrated by the fate of Owens Valley and Mono Lake, traditionally little or no consideration has been give to the adverse effects of transbasin diversions on the so-called 'basin of origin.' Those effects can be substantial, both economically (lost jobs, property taxes, and opportunities for future development) and environmentally (destruction of fisheries, riparian vegetation, and the wildlife that depend on it for shelter and food). The people whose demands are responsible for the diversions typically are unaware of these costs. Los Angeles is a good example: How can one water user among several million identify distant impacts in the Owens Valley when turning on a faucet or filling a pool? (Bates et al., 1993: 140).

The local Owens Valley residents would have used and managed the valley and its water resources very differently if they had not been bought out and overrun by Los Angeles. The Owens Valley tragedy might be seen as the result of a non-local community of interest deciding what would be the "best use" of a particular watershed. Almost everyone, including Bates et al., who support watershed level decision making, expresses justifiable outrage over the Owens Valley. And, yet, advocates of integrated watershed management fail to acknowledge that centering decision making at the watershed level will almost certainly guarantee Owens Valley types of tragedies.

Advocates of integrated watershed management focus on the watershed boundary. If that boundary can be identified and drawn, and if decisions can be made at that boundary level, then presumably most watershed problems can be adequately addressed. Yet, this logic directly contradicts the experiences and choices of water users. Left on their own, water users define and redefine multiple boundaries dealing with water allocation and usage. Boundaries encompass specific communities of interest and specific problems and challenges. No single boundary can adequately capture the diversity of interests, problems, and opportunities in a watershed. Choices

about water and land resources are ultimately value choices that involve distinct local communities of interest even in the interdependent context of a shared resource.

Collective Decision Making

Boundaries directly raises the issue of who will make decisions and how. Any such decision making arrangement raises political problems. All institutional structures for water resource decision making "are likely to have different policy orientations. They are also likely to vary in their accessibility and responsiveness to particular interests, their capacity to generate the appropriate flow of information, and their preference for certain problem solutions" (Ingram et al., 1984: 328). The choice of decision making arrangements is thus a political choice, as is the choice of watershed boundaries.

Decision making arrangements has been an issue of little concern for many of the contributors to the watershed management literature. Since many of them are not political scientists, we can understand why they would not spend much time and effort contemplating it. But the question is ultimately unavoidable, and in our view the watershed management literature has not answered it particularly well.

When the issue of collective decision making is addressed, two answers are most commonly given – consensus and elite decision making. In any consideration of consensus as a decision-making process for watersheds, there is the closely related (one might even say antecedent) question of consensus among whom. Bates et al. (1993) provide some of the strongest statements for the viewpoint that *everyone* affected by or affecting a water resource, whether located within the watershed or not. They refer to "the whole community" for any given water resource.

> The essential importance of water places a special value on the manner in which decisions are made respecting its use and availability. The whole community must be considered in those decisions, and all interests must have a meaningful opportunity to participate (Bates et al., 1993: 182).

Bates et al. (1993: 8-9) state clearly their view, for example, that everyone from Southern California to eastern Nebraska is affected by Denver's transport of water from the Western Slope, and that therefore decisions about Denver's water use should be made with input from "Tucson, Albuquerque, Las Vegas, Reno, Boise, Colorado Springs, and Salt Lake City."

In practical settings, large-scale, consensus-based decision making has led to gridlock, a "something for everyone" form of distributive policy (see Milon, Kiker, and Lee, 1998, for an account of those results in the Everglades Restoration Project), and exhaustion. Stream adjudications in several western states, such as Arizona and New Mexico, are based on a form of consensus decision making. Hundreds of water appropriators bargain and negotiate with one another in the shadow of a court, searching for agreement on water rights and water allocations. The adjudications often last several decades and end, not with a comprehensive settlement, but with parties withdrawing or abandoning their claims, state and federal agencies making side

payments to some parties to remove them from the adjudication, and ultimately some form of a settlement imposed by a legislature, or agreed upon by the remaining parties.

Bates et al. (1993: 3) describe current western water policy as "a Gordian knot." Yet it seems a reasonable question to pose whether the meaningful involvement of the interests of every person or group that affects or is affected by a watershed, even those separated by distance and time, would combine with the requirement of consensus-based decision making in such a way as to cut the Gordian knot or pull it even tighter.

Elite decision making has also been given some consideration. Integrated watershed management has been likened to a restoration of rational planning (Walther, 1987: 440), a form of decision making in which expert elites draw together information about all alternatives in order to reach reasoned conclusions about which choices will best serve social goals. At the risk of belaboring what will seem instantly obvious to most political scientists, we note briefly that criticisms leveled at this approach include: (1) it unjustifiably presumes that social goals are known with some precision and remain constant over the relevant period (Milon, Kiker, and Lee, 1998); (2) it also unjustifiably presumes that the number of social goals to be pursued is limited and that those goals do not contradict one another (O'Toole, 1993); and (3) it places unreasonably high information demands upon the decision makers, who must comprehend everything from land use planning to biological systems and their responses to economic and political dynamics (Newson, 1997: 311). Ultimately, the search for a more "rational" decision making structure may be a misguided search for a sort of bloodless organization.

Furthermore, (to belabor another point) any non-consensus based type of decision making, such as elite rule, may result in the exploitation or oppression of underrepresented or minority interests. Jacobs (1978) vividly recounts the tragic tale of how watershed planning in the Rio Grande systematically worked to the detriment of an "inconvenient" minority of native Latino and Indian farmers in the Espanola valley north of Santa Fe. Despite procedural guarantees of public hearings and participation, regional watershed planning for the Rio Grande became in effect "top-down planning." The endeavor to make decisions for and about the watershed as a whole led to the diminution of the effects on one or more small (and relatively powerless) subwatershed communities.

All collective decision making arrangements exhibit different combinations of strengths and weaknesses. Consensus protects individual rights and values from being overrun by a group, but decision making costs may be exorbitant. Elite decision making may substantially reduce decision making costs, but at the expense of individuals rights and values. These tradeoffs stem from the inherent tension between individuals and communities, and thus cannot be avoided. However, the weaknesses of each type of decision making can be somewhat ameliorated through the use of different combinations of decision making arrangements. For instance, consensus decision making can be limited by a decision rule that forces a choice if consensus cannot be reached. Minority interests may be protected in an elite decision making process by providing avenues of appeal.

In the watersheds that we examined, different decision making arrangements were used in different settings. In no watershed was a single type of decision making used. For instance, in

Colorado, consensus is the primary method of decision making concerning the development, alteration, and transfer of water rights covered by the prior appropriation doctrine. If a water appropriator wants to acquire a new water right, or change an existing water right, he or she files an application announcing such an intention with a water court. The application is widely publicized and all water rights holders in the watershed are invited to challenge the application. The applicant and challengers work with a water referee, who is an employee of the court, to settle their differences and achieve consensus concerning the contested water rights. (Water rights holders who do not openly challenge the application are assumed to consent to it.) If consensus is achieved, the applicant and challengers devise their own agreement, which is decreed by the court. If no consensus is achieved, a trial is held before a water judge. Water courts are similar to courts of equity, and therefore, the judge attempts to build a consensus agreement. If that is not possible, the judge issues a decree, which may be appealed to the Colorado Supreme Court.

In California, water appropriators in a number of watersheds have used a combination of consensus and judicial decision making to define groundwater rights (Blomquist 1992). Water users in the Mojave River watershed, including municipalities, ranchers, and industries, have used a combination of an overlapping jurisdiction (the Mojave Water Agency, which includes the entire watershed and more) and a court adjudication to handle allocation and augmentation of water supplies, while deferring primarily to state and federal agencies to rule making and enforcement regarding environmental protection.

In the San Juan Creek watershed, water users and their communities have established a combination of overlapping and interlocked decision-making arrangements that include five special-purpose districts, three joint-powers agencies, and an advisory committee with representatives from the municipalities and the largest private land owner within the watershed.

In the San Gabriel and Santa Ana River watersheds, each of which is plainly divided by topography and hydrogeology into upper (inland) and lower (coastal) subwatershed areas, multi-member "watermasters" composed of upper and lower area representatives have for decades overseen the administration of agreements about the upstream-downstream allocation of water supply. The Santa Ana River watershed also features a formal joint-powers watershed authority and an informal "watershed group" composed of individuals from a mix of public jurisdictions and private organizations. In the San Gabriel River watershed, a lower-area special district was created to fund and manage groundwater replenishment, and an upper-area water quality authority was established to coordinate the response to serious groundwater contamination problems found there.

Advocates of integrated watershed management make the mistake of assuming that integration requires a single type of decision making rule, or aggregation rule. Relying upon a single type of decision making makes for a fragile form of governance in which conflict among competing interests and values cannot be adequately addressed. In any watershed in the real world, each such aggregation rule will open opportunities for some individuals or groups to ignore, exploit, or oppress others. When the watershed is reconceived as a political unit, fundamental questions of political theory return to be debated and decided once again in this new setting—what will it be, a Rousseauian community or a Madisonian compound republic?

In the watersheds we have examined, and in most others of which we are aware, the water users are opting for the latter. In a study of intergovernmental arrangements for deciding upon and implementing alternatives for wastewater treatment, O'Toole (1993) observed that the governance issue of community autonomy was itself one of the values with which participants were concerned, along with the management issues of efficiency and regulatory compliance.

In addition to some sort of identity-based concern for autonomy for its own sake, there may be a pragmatic political calculus at work that recognizes the uncertainty and surprise inherent in resource management (Walters, 1986). In a changeable ecosystem nested within a changeable social, political, and economic setting, where multiple values are mingled with multiple constraints, one can never really be sure whether one's position today will prevail tomorrow: in a physical or cultural or regulatory context, any group can be "downstream" sometime. The Rawlsian bargain under those circumstances may be to be part of a community that has to be recognized and reckoned with, rather than to be just one contributor to the *vox watershed*.

Watershed Management

Boundary definition and collective choices implicate another issue – the authority and activity of watershed arrangements. What will an integrated watershed manager do? Like the issue of boundaries and collective choice, it has not been adequately addressed in the integrated watershed management literature. The watershed authority will, presumably, have the ability to engage in a wide variety of collective choice and operational level activities. Collective choice activities would include promulgating rules, defining property rights, enforcing those rules and rights, levying taxes to pay for its activities, and so forth. Operational level activities would include allocating water, restoring riparian habitat, engaging in water purification, and so forth. What is important is not so much the specific collective choice and operation level activities, but that they are integrated. That is, the activities of the authority should reflect the interconnectedness of the watershed.

The ability of a large bureaucracy to effectively and comprehensively engage in and coordinate a multitude of activities has suffered sustained criticism from public administration theorists and political scientists for more than five decades (Simon 1954; Knott and Miller 1987; Chisholm, 1989, Miller 1992). Organizational integration has its own costs of internal coordination and communication, information distortion, control losses, and the like, described in the political economy literature on bureaucratic pathologies. The costs of integration on the scale of a watershed may be quite substantial, as suggested by Behrman (1993: 11-12):

> There was a study made some years ago…. of the Columbia River basin, which is if anything even more complicated than the South Platte basin. The study looked for any empirical evidence (and there again, the control is very fractured) that a unified control system would produce superior results compared to the existing system, which is very similar to the South Platte. The conclusion was that there was no evidence that it would be superior. The unified system, by bringing in bureaucratic control, creates unanticipated results that are not all that favorable.

In Arizona, California, and Colorado, we uncovered no instances of large, comprehensive bureaucracies armed with extensive authority to manage and engage in a wide variety of activities. Quite to the contrary, water appropriators explicitly chose not to center all water activities in a single agency. In Arizona, which is the most centralized of the three states, specific limitations were placed on the authority that the Arizona Department of Water Resources (ADWR) could exercise when it was first created in 1980. ADWR was granted the authority to only govern groundwater, and in governing groundwater, it was only allowed to manage and regulate demand for water, it was not allowed to develop and manage supplies of water.

In Colorado, water appropriators have repeatedly acted to limit extending the authority of the State Water Engineer and the Division Engineers. For instance, consideration was given to granting division engineers the authority to act as water referees within water courts. Water appropriators adamantly opposed such an idea and insisted on referees who would be independent of the state and division engineers and who would be employees of the courts.

Also, in 1969, when the State Engineer began exercising his newly granted rule making authority, appropriators challenged each rule in water court. Conflict was so intense that several cases ended before the Supreme Court. The Supreme Court imposed a set of procedural rules on the State Engineer. Furthermore, the State Engineer has adopted rule making procedures in which appropriators are actively involved in defining the rules, and the final rules are automatically brought before a water court for vetting. Water appropriators, who exercise considerable authority in the context of water courts, were able to bring the State Engineer's rule making authority within the purview of the water courts.

When faced with choices concerning the creation of forms of water management authority, citizens in Arizona, California, and Colorado often refused to centralize decision making within a single entity. Rather, management authority is divided among numerous organizations.

What explanation can be given of the motivations and choices of these water users in crafting such complicated and multi-layered arrangements? A political science explanation can be constructed to provide an understandable account. It would draw heavily upon the literature on local public economies that has emerged to explain complex polycentric systems such as the governance of metropolitan areas in the absence of a metropolitan government (U.S. ACIR, 1987; U.S. ACIR, 1988; Oakerson, 1999). The most important components of such a "public economies" explanation would be the provision-production distinction, specialization, economies and diseconomies of scale, and coordination versus hierarchy.

In all social settings—from households to watersheds—decisions about provision of desired resources, goods, and services may be made without actually engaging in the production of those desired resources, goods, and services. Members of a household decide how (and how much) they will obtain of the necessities and conveniences of life—housing, food, schooling, entertainment—but they do not necessarily produce their own housing, their own food, their own schooling, or all of their own entertainment. Similarly, a community of individuals may organize a town, a water district, or a Web page and decide what services they want to receive, what forms and amounts of revenue they will contribute, what content they want to disseminate, and so forth. These are provision decisions. They do not imply that the individuals in the

community will actually police the streets, construct wells or pipes, or make the home page; they may choose to procure any or all of those services from other individuals or organizations that produce them (Oakerson 1999).

In a watershed, the provision-production distinction can help to explain some of the number and variety of organizations that exist when water users create those organizations themselves. As in the watersheds described here, there may be a few organizations that produce water from large-scale projects, but a large number of smaller organizations that decide how much they want to receive and pay for relative to other water sources to which they may have access. A group of pumpers who share the same groundwater basin may decide to establish a replenishment program, but they may choose to contract with an agency that operates flood control facilities to use those facilities for water conservation rather than construct and operate their own. Many of the organizations described in the cases here were primarily *providers*, representing or organizing smaller communities of individuals and then entering into contractual or other arrangements with *producers* of water supplies, flood control, contamination remediation, etc. Classifying the organizations within a watershed into provider and producer categories can help to begin sorting out the arrangements among them, making a different kind of sense out of what may appear at first blush to be mere fragmentation.

The distinction between provision and production brings into view the concept of functional specialization. There may be, and often are, advantages in organizing activities by taking advantage of specialization. Operating physical facilities such as dams is a task that could be undertaken by the same agency that also contracts for water supplies, monitors water quality, and sets groundwater production targets for every basin within a watershed, but it certainly does not have to be. There may even be good reasons for having a separate organization perform that task—or for that matter, a separate organization performing each of the tasks in that short list. In the watersheds described in this paper, water users appear to have made deliberate choices in both directions—sometimes adding a new function to the portfolio of an existing organization (e.g., having the county flood control district operate the sea-water barrier in the San Gabriel watershed), other times creating a new organization (e.g., a joint-powers agency to organize and finance contamination remediation efforts in the Main San Gabriel Basin).

The choice about whether to add another organization or increase the responsibilities of an existing one will depend upon matters such as the skills required for the function, the resources available within existing organizations, the costs of coordination if a new organization is created, and the political issues of governance and control. There is not a single answer that fits all situations. When watershed management occurs from the ground up, it is to be expected that water users will create some single-function entities and other multiple-function ones based on considerations such as these. Their choices do not necessarily reflect hapless fragmentation or rampant duplication; indeed, when organizations truly specialize, they are not duplicates (Oakerson and Parks 1988).

The other concept that follows closely with those of specialization and the distinction between provision and production is that of scale. Some activities are less costly and more efficient if organized on a large scale. Others exhibit diseconomies of scale, becoming inefficient or cumbersome when too many people or too diverse a set of interests is involved.

It might well represent wasteful duplication if each municipality in a watershed such as those in southern California had built its own aqueduct to the Colorado River or to northern California, because such a facility exhibits significant economies of scale. Instead, municipalities in southern California chose to either join the regional Metropolitan Water District, or to contract with the state for access to its State Water Project. These arrangements allowed local communities to take advantage of scale economies.

In addition to drawing upon a local public economies argument, the explanation for water users crafting complex multi-organizational governing arrangements would also draw upon the arguments made in the previous two sections. A watershed may be a single, interrelated physical system, but it places people in distinctly different positions. Some will be downstream, others up. Some may overlie a capacious and easily replenished groundwater basin, others will not. Some may reside adjacent to wetlands or riparian habitat that others wish to see preserved. Some may be at risk from contamination while others enjoy relatively pristine water. Within this single physical system is a more complicated social one.

Overlay upon those differences among people's situations within a watershed the myriad other distinctions that come from the broader social, economic, and cultural setting within which the watershed is found. Distinctions of wealth, ethnicity, religion, occupation, social status and the like too will exist among and between watershed residents and the groups or communities with which they identify. When water users create water resource management institutions, they tend to organize at least some of those entities around communities of interest. Their communities of interest may be defined by their physical position in the watershed, by their identity in the larger social system, or (most likely) a mixture of both. The result is that water users draw multiple boundaries to reflect their differing positions.

Furthermore, decision making processes vary within and among different organizational arrangements. Consensus building, super-majority voting rules, simple majority voting rules, and judicial decisions are combined and nested, allowing for both conflict resolution and final decisions to be made.

Conclusion

The study of watershed management is controversial. Controversy has centered on issues of reform. Advocates of integrated watershed management respond to watershed problems by pressing for consolidation of sub-watershed organizations, the creation of a watershed level authority, and the granting of broad and sweeping powers to such an authority. Even though integrated watershed management has been advocated in one form or another for the past 25 years, elected officials and citizens have rarely adopted such an approach. Invariably, citizens have instead opted to create multiple overlapping organizations that exercise limited powers and that use different types of collective choice procedures when dealing with water.

The integrated watershed management literature cannot account for such complexity and diversity in governing arrangements. Instead, the integrated watershed management literature critiques such practices, although the critiques are not grounded in empirical evidence, and then proposes institutional arrangements that do not fit easily with existing conditions and practices. What is sorely needed if we are to improve the governance and management of watersheds is an

empirically grounded explanation that both accounts for existing governing practices and that can prescribe reforms to address pressing watershed problems. In this paper, we sketched out a political science explanation of existing watershed management practices. Political scientists, however, have much more to do and to learn from the real world in order to be helpful in understanding, explaining, and perhaps even providing some advice about watershed management. A better understanding of inter-organizational and intergovernmental arrangements, including especially federalism and systems of separated and shared powers, is still needed. A better understanding of non-governmental governance arrangements is needed, too, since water (and probably other natural) resource arrangements seem often to begin with groups, associations, cooperatives, and a variety of forums that have no formal governmental recognition or existence but nevertheless provide essential governance functions. The systems devised in the real world for the management of natural resources may have a lot to teach us about the enduring questions of who governs, and how.

Bibliography

Abbott, P.O. 1985. Description of Water-Systems Operations in the Arkansas River Basin, Colorado. Lakewood, CO: U.S. Geological Survey.

Abbott, Carl, Stephen J. Leonard, and David McComb. 1994. Colorado: A History of the Centennial State. 3d edition. Niwot, CO: University Press of Colorado.

Bartlett, Robert V. (1990) "Comprehensive Environmental Decision Making: Can It Work?" In Environmental Policy in the 1990s. Norman J. Vig and Michael E. Kraft, eds. Washington, DC: CQ Press

Bates, Sarah, David Getches, Lawrence MacDonnell, and Charles Wilkinson (1993) Searching Out the Headwaters: Change and Rediscovery in Western Water Policy. Washington, DC: Island Press

Behrman, Robert (1993) "Legal Issues Associated with an Integrated Watershed Management Approach." Colorado Water. Volume 10, Number 6 (December), pp. 11-12

Blomquist, William (1992) Dividing the Waters: Governing Groundwater in Southern California. San Francisco, CA: ICS Press

Bolte, John et al. (1999) "Developing Methods and Tools for Watershed Restoration: Design, Implementation, and Assessment in the Willamette Basin, Oregon—Summary." In Proceedings: 1999 Water and Watershed Program Review. EPA/NSF Partnership for Environmental Research. April 19-21, 1999. Silver Spring, MD. pp. 5-6

Brooks, Kenneth N. et al. (1997) Hydrology and the Management of Watersheds. Second Edition. Ames, IA: Iowa State University Press

Caglioti, G. (1992) The Dynamics of Ambiguity. Berlin: Springer Verlag

Covich, Alan et al. (n.d.) “Ecological Integrity and Western Water Management: A Colorado Perspective.” Water in the Balance Series, Paper No. 3. Fort Collins, CO: Colorado Water Resources Research Institute. <cwrri.colostate.edu/pubs/balance>

Davis, Sandra K. (1999) “Water Policy in Western States.” Paper presented at the 1999 Annual Meeting of the Western Political Science Association, Seattle, WA, March 25-27, 1999. 35 pp.

Deyle, Robert (1995) “Integrated Water Management: Contending with Garbage Can Decisionmaking in Organized Anarchies.” Water Resources Bulletin. Volume 31, Number 3 (June), pp. 387-398

Dille, J.M. (1960). Irrigation in Morgan County. Ft. Morgan, CO: Farmers State Bank.

Doppelt, Bob, Mary Scurlock, Chris Frissell, and James Karr (1993) Entering the Watershed: A New Approach to Save America’s River Ecosystems. Washington, DC: Island Press

Dworsky, Leonard, David Allee, and Ronald North (1991) “Water Resources Planning and Management in the United States Federal System: Long-Term Assessment and Intergovernmental Issues for the Nineties.” Natural Resources Journal. Volume 31, Number 3 (Summer), pp. 475-547

Dworsky, Leonard, Ronald North, and David Allee, eds. (1988) Water Resources Planning and Management in the United States Federal System. Henniker, NH: Engineering Foundation

Dzurik, Andrew A. (1995) Water Resources Planning. Revised Edition. Lanham, MD: Rowman & Littlefield

Fortman, L. (1990) “The Role of Professional Norms and Beliefs in the Agency-Client Relations of Natural Science Bureaucracies.” Natural Resources Journal. Volume 30, pp. 361-380

Gregg, Frank, Douglas Kenney, Kathryn Mutz, and Teresa Rice (1998) The State Role in Western Watershed Initiatives. Executive Summary. Boulder, CO: Natural Resources Law Center

Grumbine, R.E. (1995) “What Is Ecosystem Management?” Conservation Biology. Volume 8, pp. 27-38

Haeuber, R. (1996) “Setting the Environmental Policy Agenda: The Case of Ecosystem Management.” Natural Resources Journal. Volume 36, pp. 1-28

Hagman, Donald G. (1970) "Regionalized-Decentralism: A Model for Rapprochement in Los Angeles." Georgetown Law Journal. Volume 58, Numbers 4 & 5 (March-May), pp. 901-953

Harkins, Joseph F. and Margaret A. Baggs (1987) “An Alternative to Public Health-Based Environmental Protection: A Comprehensive Environmental Protection Concept.” University of Kansas Law Review. Volume 35, Number 2 (Winter), pp. 431-441

Heathcote, Isobel W. (1998) Watershed Management: Principles and Practice. New York, NY: John Wiley & Sons

Hinchcliffe, Fiona, John Thompson, and Jules Pretty, eds. (1998) Fertile Ground: The Impacts of Participatory Watershed Management. Stylus Publishers

Holling, C.S. (1978) Adaptive Environmental Assessment and Management. New York, NY: John Wiley & Sons

Holling, C.S. (1986) "Resilience of Ecosystems, Local Surprise and Global Change." In Sustainable Development of the Biosphere. W. Clark and R. Munn, eds. Cambridge, UK: Cambridge University Press
Huber, Thomas. 1993. Colorado: The Place of Nature, The Nature of Place. Niwot, CO: University Press of Colorado.

Ingram, Helen, Dean Mann, Gary Weatherford, and Hanna Cortner (1984) "Guidelines for Improved Institutional Analysis in Water Resources Planning." Water Resources Research. Volume 20, Number 3 (March), pp. 323-334

Interstate Conference on Water Policy (1990) Toward National Water Policy Coodination: The Challenge of Improving Intergovernmental Relations. Washington, DC: Interstate Conference on Water Policy

Jacobs, Sue-Ellen (1978) "'Top-Down Planning:' Analysis of Obstacles to Community Development in an Economically Poor Region of the Southwestern United States." Human Organization. Volume 37, Number 3 (Fall), pp. 246-256

Jones, E. Bruce and Timothy J. Ward (1985) Watershed Management In the Eighties. American Society of Civil Engineers

Kiser, Larry and Elinor Ostrom (1982) "The Three Worlds of Action." In Strategies of Political Inquiry. Elinor Ostrom, ed. Beverly Hills, CA: Sage Publications

Kenney, Douglas S. (1997) Resource Management at the Watershed Level: An Assessment of the Changing Federal Role in the Emerging Era of Community-Based Watershed Management. Report for the Western Water Policy Review Advisory Commission. Denver, CO: Western Water Policy Review Advisory Commission

Kraft, Steven et al. (1999) "Understanding the Social Context for Ecological Restoration in Multiple-Ownership Watersheds: The Case of the Cache River in Illinois--Summary." In Proceedings: 1999 Water and Watershed Program Review. EPA/NSF Partnership for Environmental Research. April 19-21, 1999. Silver Spring, MD. p. 10

Lackey, R. (1998) "Ecosystem Management: In Search of the Elusive Paradigm." Human Ecology Review. Volume 4, pp. 107-113

Lal, R., ed. (1999) Integrated Watershed Management in the Global Ecosystem. CRC Press

Libecap, Gary D. (1994) "The Conditions for Successful Collective Action." Journal of Theoretical Politics. Volume 6, Number 4, pp. 563-592

Loucks, Daniel P. (1998) "Watershed Planning: Changing Issues, Processes and Expectations." Water Resources Update. Number 111 (Spring), pp. 38-45

MacDonnell, Lawerence. 1988. "Colorado's Law of 'Underground Water': A Look at the South Platte Basin and Beyond" University of Colorado Law Review 59(3):579-625.

MacKenzie, Susan H. (1996) Integrated Resource Planning and Management: The Ecosystem Approach in the Great Lakes Basin. Washington, DC: Island Press

Mehls, Steven. 1984. The New Empire of the Rockies: A History of Northeast Colorado. Denver: Bureau of Land Management.

Milon, J. Walter, Clyde F. Kiker, and Donna J. Lee (1998) "Adaptive Ecosystem Management and the Florida Everglades: More Than Trial-and-Error?" Water Resources Update. Number 113 (Fall), pp. 37-46

Morgan, Russell (1965) "The Role of Ground Water in Comprehensive River Basin Planning." Ground Water. Volume 3, Number 2 (April), pp. 16-18

Naiman, Robert I., ed. (1994) Watershed Management: Balancing Sustainability and Environmental Change. Berlin: Springer Verlag

Nakamura, Liane and Stephen M. Born (1993) "Substate Institutional Innovation for Managing Lakes and Watersheds: A Wisconsin Case Study." Water Resources Bulletin. Volume 29, Number 5 (October), pp. 807-821

National Research Council (1996) Linking Science and Technology to Society's Environmental Goals. Washington, DC: National Academy Press

Newson, Malcolm D. (1997) Land, Water and Development: Sustainable Management of River Basin Systems. Second Edition. London, UK: Routledge

O'Toole, Laurence J., Jr. (1993) "Interorganizational Policy Studies: Lessons Drawn from Implementation Research." Journal of Public Administration Research and Theory. Volume 3, Number 2, pp. 232-251

Ostrom, Vincent and Elinor Ostrom (1965) "A Behavioral Approach to the Study of Intergovernmental Relations." The Annals of the American Academy of Political and Social Science. Volume 359 (May), pp. 137-146

Paskowski, Andrew (1988) “Groundwater and Watershed Protection.” Environmental Planning Quarterly. Volume 6, Number 1 (Spring), pp. 2-10

Petersen, Margaret S. (1984) Water Resources Planning and Development. Englewood Cliffs, NJ: Prentice Hall

Radosevich, G.E., K.C. Nobe, D. Allardice, and C. Kirkwood. 1976. Evolution and Administration of Colorado Water Law: 1876-1976. Fort Collins, CO: Water Resources Publications.

Reimold, Robert J. (1998) Watershed Management: Practice, Policies, and Coordination. New York, NY: McGraw-Hill

Reuss, Martin (1992) “Coping With Uncertainty: Social Scientists, Engineers, and Federal Water Resources Planning.” Natural Resources Journal. Volume 32, pp. 101-135

Sabatier, Paul and James Quinn (1999) “When Do Stakeholder Negotiations Work? A Multiple-Lens Analysis of Watershed Restorations in California and Washington—Summary.” In Proceedings: 1999 Water and Watershed Program Review. EPA/NSF Partnership for Environmental Research. April 19-21, 1999. Silver Spring, MD. p. 17

Smith, Duane. 1992. Rocky Mountain West: Colorado, Wyoming and Montana 1859-1915. Albuquerque: University of New Mexico Press.

Stanley, T.R. (1995) “Ecosystem Management and the Arrogance of Humanism.” Conservation Biology. Volume 9, pp. 255-262

Swallow, S.K. (1996) “Economic Issues in Ecosystem Management: An Introduction and Overview.” Agricultural and Resource Economics Review. Volume 25, pp. 83-100

Tarlock, A. Dan (1994) “The Nonequilibrium Paradigm in Ecology and the Partial Unraveling of Environmental Law.” Loyola of Los Angeles Law Review. Volume 27, pp. 1121-1144

Trelease, Frank 1971. Federal-State Relations in Water Law. National Water Commission Legal Study, No. 5.

Tucker, Robert K. et al. (1999) “Integrating Models of Citizen Perceptions, Metal Contaminants, and Wetlands Restoration in an Urbanizing Watershed—Summary.” In Proceedings: 1999 Water and Watershed Program Review. EPA/NSF Partnership for Environmental Research. April 19-21, 1999. Silver Spring, MD. p. 18

Tyler, Daniel. 1992. The Last Water Hole in the West. Niwot, CO: University Press of Colorado.

United States Advisory Commission on Intergovernmental Relations (1987) The Organization of Local Public Economies. Report A-109. Washington, DC: U.S. Advisory Commission on Intergovernmental Relations

United States Advisory Commission on Intergovernmental Relations (1988) Metropolitan Organization: The St. Louis Case. Report M-158. Washington, DC: U.S. Advisory Commission on Intergovernmental Relations, September 1988

United States Advisory Commission on Intergovernmental Relations (1994) Planning to Govern. Report No. M-191. Washington, DC: U.S. Advisory Commission on Intergovernmental Relations

United States Coastal America Organization (1994) Toward a Watershed Approach: A Framework for Aquatic Ecosystem Restoration, Protection, and Management. Washington, DC: Executive Office of the President

United States Environmental Protection Agency, Office of Water (1991) The Watershed Protection Approach: An Overview. Report EPA/503/9-92/002. Washington, DC: U.S. Government Printing Office

United States Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds (1995) Watershed Protection: A Statewide Approach. Report EPA/841-R-95-004. Washington, DC: U.S. Government Printing Office

United States Geological Survey (1998) Watershed and River Systems Management Program: Application to Yakima River Basin, Washington. Fact Sheet. Sacramento, CA: U.S. Geological Survey

Vranesh, George. 1987. Colorado Water Law. Volume 1.

Walther, Pierre (1987) "Against Idealistic Beliefs in the Problem-Solving Capacities of Integrated Resource Management." Environmental Management. Volume 11, Number 4 (July/Aug.), pp. 439-446

Warner, James, Jon Altenhofen, and Jack Oder. 1994. Recharge as Augmentation in the South Platte Basin. Groundwater Program Technical Report #21. Fort Collins, CO: Colorado Water Resources Research Institute.

Water Environment Research Foundation (1996) Framework for a Watershed Management Program. Alexandria, VA: Water Environment Research Foundation

Whitney, Gleaves. 1983. Colorado Frontrange: A Landscape Divided. Boulder: Johnson Books

Yaffee, S.L. et al. (1996) Ecosystem Management in the United States: An Assessment of Current Experience. Washington, DC: Island Press