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BUILDING THE AGENDA FOR INSTITUTIONAL RESEARCH IN WATER RESOURCE MANAGEMENT¹

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ABSTRACT: This paper pursues more specifically the recommendations of a recent National Research Council report recommending greater attention to research on institutions in the field of water resource management. The important challenge for the future in institutional research lies in going beyond the observation that institutions are important and in explaining instead how institutions actually affect management options and outcomes. It is possible to illuminate the relationships between institutional features and water management through comparative institutional research. This paper offers recommendations for studying water institutions in a comparative context, including methodological recommendations concerning approaches to comparative institutional research, and topics for comparative institutional research that appear especially fruitful at this time. The example of conjunctive management is used to illustrate the importance of institutional factors in water management, drawing to some extent on the authors' recent experience with a comparative study of conjunctive management institutions.

(**KEY TERMS:** water resources research; institutional arrangements; water law; water management; social and political; water policy/regulation/decision making.)

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INTRODUCTION

The National Research Council's report, "Envisioning the Agenda for Water Resources Research in the Twenty-First Century," (NRC, 2001, p. 9) acknowledged that "research on institutions occupies only a very small portion of the current water research agenda." The report recommended "that efforts should be

made to invest relatively more in institutional research than has been the case in the past" (NRC, 2001, p. 33) and identified some topics on which greater investments would be beneficial in the Council's view. These included: (1) conduct comparative studies of water laws and institutions; (2) understand user organized institutions for water distribution, such as cooperatives, special districts, and mutual companies; and (3) develop legal regimes that promote ground water management and conjunctive use of surface water and ground water.

In addition to the National Research Council, various water management scholars, research institutes, government agencies, and other practitioner associations have recognized the importance of institutions in shaping water management outcomes (Western States Water Council, 1990; USACIR, 1991; Grigg, 1996; Kenney and Lord, 1999). By identifying and clarifying the relationship between institutional arrangements and water management outcomes, institutional researchers can help advance the larger goal of improving the sustainable use of water resources in the United States and elsewhere.

The calls for institutional research and the studies that identify institutions as important factors shaping water management are rarely accompanied by specific recommendations for how to research and evaluate the effects of institutions. In this paper additional and more specific recommendations are offered for the pursuit of institutional research in water resources, focusing mainly on the comparative study of water laws and institutions and user organized

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arrangements. The authors have recently completed a comparative institutional research project and recommendations reflect some of the ideas developed during that project and draw upon some examples from it (Blomquist *et al.*, 2004). Three states in the American Southwest were studied – Arizona, California, and Colorado – with substantially different institutional approaches to the division of state/local leadership and responsibility for ground water management and conjunctive water management, and with different legal regimes governing the use of ground water resources. These states’ conjunctive management experiences differ in ways that are linked to those institutional differences. It is possible to illuminate the relationships between institutional features and water management outcomes through this sort of comparative institutional research.

As a background discussion, a very brief description of the recent study is provided in order to illustrate some of the issues that arise in comparative institutional research regarding water resources, particularly with respect to conjunctive management. This paper offers two categories of recommendations for studying water laws and institutions (including user organized institutions) in a comparative context. Methodological recommendations are made concerning approaches to comparative institutional research, and some topics are recommended for institutional research that seem to be ripe for fruitful investments at this time. Through the recommendations for institutional research, the authors hope to contribute to the overall goal of building a sound agenda for water resources research in the 21st Century.

BACKGROUND DISCUSSION: EXPLORING HOW INSTITUTIONS MATTER IN A COMPARATIVE CONTEXT

Before proceeding to the recommendations, a very brief synopsis is offered of the comparative institutional study recently completed. This should shed some light on what institutional arrangements are and how questions for comparative institutional research can be framed and addressed with respect to an important water resource management practice such as the conjunctive management of surface water and ground water.

Conjunctive water management has been advocated in the water management and policy literature for nearly 60 years as a means of achieving multiple water management objectives under strong natural and regulatory constraints (e.g., Conkling, 1946; Thomas, 1955; Todd and Priestaf, 1997). Conjunctive

water management involves the coordinated use of surface water supplies and storage with ground water supplies and storage. At times when surface water supplies are comparatively plentiful, conjunctive water management encourages the direct use of those surface supplies as well as storing them to the extent possible behind dams or other impoundment structures. Ground water basins are tapped less during these wet periods, allowing them to refill naturally or through deliberate replenishment efforts. When surface water supplies are comparatively scarce and may need to be conserved for instream flow needs, stored ground water can be tapped to supply irrigation or urban uses. The idea of conjunctive management is certainly not new, but the practice of conjunctive management has lagged behind the promise it is believed to hold.

Institutional factors such as the rules governing water use and the organizational arrangements for water management are likely to play important roles in determining whether, when, and how conjunctive management programs develop and perform. Institutions facilitate the ease with which multiple actors interact in complex situations, prescribing what actions are allowed, required, or forbidden in given situations (Crawford and Ostrom, 1995). Thus, institutions are especially significant when a task requires coordination. Given the organizational and physical complexity involved with conjunctive management, it is likely to require considerable amounts of coordinated behavior. For instance:

- Surface water facilities, such as dams, reservoirs and water distribution systems, must be operated in coordination with ground water supplies, with underground storage capacity, and with the wells and pipes for ground water conveyance. Each of these facilities may be owned, operated, or regulated by distinct public or private organizations. Each of those organizations is governed by rules specifying what it may, must, and must not do. In the United States, those governing rules may be set at local, state, or national levels.
- Extensive monitoring of the conjunctive management operations and of water supply and storage conditions, and the exchange of information from that monitoring, are essential to conjunctive management success.
- Ambient environmental and ecological parameters must be maintained – stream flows and surface water quality, flood control needs, riparian and aquatic habitat conditions – which are often governed or monitored by other rules and organizations.
- Environmental impacts can follow from conjunctive management projects, including land subsidence

or seawater intrusion from excessive aquifer draw-down, soil saturation from excessive aquifer replenishment, and migration of contaminants in either case. These issues may be within the jurisdiction of the same organizations that operate the facilities for the conjunctive management program, but often they are within the jurisdiction of still other (typically public) organizations.

In sum, there are institutional issues and effects at every step in even the simplest of conjunctive management projects. Those institutional arrangements can be conducive to success, or they can present substantial barriers.

The important challenge for the future in institutional research lies in going beyond the observation that institutions are important. It involves peering inside the “black box” of institutional processes and effects, to provide explanations of how institutions matter – how they prompt people to try to change management practices, how they ease or hinder those changes, how they shape the management alternatives water users and organizations consider and adopt, and how they affect the outcomes that result. Meeting that goal requires comparative and empirical institutional analysis. It must be comparative in order to have a chance of isolating institutional effects from the myriad of other influences on a water management regime at any particular place and time. It must be empirical in order to develop applied knowledge that can provide the foundation for well designed water management practices and policies. A comparative empirical institutional analysis was the aim as the effects of institutional arrangements upon conjunctive management practices and outcomes in Arizona, California, and Colorado were studied (Blomquist *et al.*, 2001; Blomquist *et al.*, 2004). A combination of document collection, field interviewing, and data analysis were used to identify the key features of water rights institutions and water management organizations that shape conjunctive management.

Water rights were found to affect conjunctive management in expected and unexpected ways. Poorly or incompletely specified rights to the use of surface or ground water have impeded the development of conjunctive management projects, especially in California. In California, ground water appropriators in a basin must first define their ground water rights relative to one another before conjunctive management is undertaken. In Arizona and Colorado, water users did not engage in conjunctive management until the legislatures of each state established well defined rights in ground water.

Property rights that provide individuals or organizations with assurances concerning the storage and

recapture of underground water supplies – which exist in the Active Management Areas of Arizona, in some of California’s adjudicated ground water basins, and in tributary ground water basins in Colorado – have promoted the establishment of conjunctive management projects, including some fairly large scale projects in Arizona and California.

Finding that well defined property rights in ground water promotes conjunctive management confirms what analysts have long suspected (e.g., see USACIR, 1991; MacDonnell *et al.*, 1994); however, well defined property rights in ground water may result in unanticipated and not entirely desirable consequences. For instance, given the hydrological connections between ground and surface water, some scholars have advocated the application of a single property rights framework in order to give legal recognition to the physical interactions. If such a framework were in place in Arizona, ground water pumpers would no longer be allowed to dry up surface water sources without being held accountable. Colorado, unlike Arizona or California, incorporated ground water that is hydrologically connected to a river or stream, also known as tributary ground water, into the state’s existing prior appropriation system. The rights of tributary ground water users are almost universally junior to surface water rights. Consequently, tributary ground water users are not allowed to adversely affect senior water rights, and if they do, they may be held accountable. Certainly, this was the outcome that was desired by incorporating tributary ground water into the prior appropriation doctrine. The unanticipated and undesirable consequence is that it has precluded the use of tributary ground water basins for long term storage and drought management. Millions of acre feet of ground water in the South Platte and Arkansas River Basins cannot be tapped, even though Colorado is experiencing a drought, because pumping that water would adversely affect senior water rights holders. Conjunctive water management in Colorado is used to protect the rights of senior water rights holders, which means supporting surface water flows.

Institutional arrangements that reduce the transaction costs of coordinating water users’ acquisition of supplemental supplies have also facilitated the development of conjunctive management projects in Arizona, California, and Colorado. In particular, large surface water projects have introduced much needed flexibility because project water is governed by a set of rights and rules that allow it to be more readily leased or transferred than water governed by prior appropriation. Participants in conjunctive management projects typically do not acquire rights in native surface water (which are typically hard to come by and quite expensive); rather, they contract with the

owners and operators of large surface projects for surplus water.

As the complex interaction of institutional arrangements with water management choices were traced, it became clear that simplified institutional solutions sometimes envisioned in purely analytical treatments (e.g., integrated resource management agencies, water markets) in and of themselves are not likely to provide many answers to water dilemmas in Arizona, California, and Colorado and probably not in other western states. Instead, the policy options that are suited to conjunctive management, or any other technique of improved water resource management, must be applicable to a particular setting. Perhaps ironically, those characteristics of the particular setting may become apparent only through comparative analysis that encourages researchers to notice and address how one location differs from others.

We discovered that these distinctions included aspects of the states that had nothing in particular to do with water resources *per se*, such as the state's history and practices with respect to state/local government relations. California and Colorado have "home rule" traditions of leaving local communities considerable latitude to develop their own organizational arrangements and policies with respect to many other public services besides the provision and protection of water supplies. Those traditions are reflected in their water management practices as well and have influenced the development of conjunctive management in those states. Arizona has a contrasting tradition as a nonhome rule state, and that has shaped its water management approaches as well as its practices with respect to other public services. Recommendations for institutional reforms to promote conjunctive management in Arizona, California, and Colorado that do not take into account these long standing aspects of the states' political cultures overlook the significant influence of the broader institutional context within which water management occurs.

RECOMMENDATIONS FOR INSTITUTIONAL RESEARCH IN WATER RESOURCES

If the 21st Century water resources research agenda is to include studies comparing water laws and institutions, and improved understanding of user created organizations, it is worth considering how to go about those tasks. The authors have some recommendations for colleagues who may be undertaking new studies in these areas soon. These methodological points are described first, because the authors believe these methodological matters to be relevant for a great many topics of institutional research in water

resources. Some topics for institutional research are described later.

Some Methodological Considerations in Comparative Institutional Analysis

Selecting Cases for Comparison in Ways That Help Isolate Institutional Factors – At first blush, this recommendation seems too obvious to include, but there is more to isolating institutional factors than finding cases that differ on the institutional characteristics of interest (i.e., having enough variation on the dependent variable). To isolate institutional effects, it is also necessary that cases be as similar to one another as possible on other potentially confounding factors. Failing to do so may leave one in a hopeless muddle where water management outcomes cannot be attributed to institutional factors or to any other category of influences, because each case varies so much from the others on so many dimensions.

Because physical and economic factors matter so greatly in the development of conjunctive management projects, for example, the states of Arizona, California, and Colorado were selected for this study precisely because they bore some similarities to one another in those respects. All three have arid to semi-arid conditions, erratic precipitation, substantial geographic imbalances between the location of abundant water supply and the locations of greatest demand, significant growth and urbanization pressures, and higher levels of economic development than most of their neighboring southwestern states. This is certainly not meant to overlook their differences on these and other dimensions. It is rather to say that these three states had greater similarities to one another than they had to other cases on these dimensions, while differing substantially with respect to their water laws and institutions. Without guaranteeing us any results or success, the selection of cases created at least the possibility for a comparative institutional analysis where the institutional differences had a chance of standing out among the many other factors that influence water management practices.

Choosing cases that are similar in physical and economic conditions but differ on institutional variables of interest also helps provide an alternative approach to the "induced institutions" work that has appeared in the natural resource management literature in the past, including water management literature in particular (Demsetz, 1967; Anderson and Hill, 1983). That view, which posits that institutional changes are epiphenomena of resource scarcity, is useful and provocative, but the comparative institutional analysis field also needs studies where resource scarcity conditions were similar but institutions

developed differently anyway, in order to probe the origins and effects of institutions in additional useful ways.

For comparative institutional analysis, selection of cases is arguably more important than the number of cases (Scharpf, 1997; Agrawal, 2002). (The number of cases is likely to be limited in comparative institutional analysis anyway. This tends to be time consuming and labor intensive research, and particularly for cross state or cross national comparisons, the number of cases is constrained automatically.) For example, a study of water transfers with a dozen cases of completed transactions and a dozen cases of failed transactions, but where the cases also differ substantially on several dimensions apart from the institutional variables of interest, may yield fewer useful results than a study of half a dozen cases where the institutional variables represented the greatest distinctions among the cases. In this research on conjunctive management, observations were limited to three states, but still had substantial diversity of conjunctive management projects, variation among organizations involved in conjunctive management, and different rules within states from which to draw valuable comparisons.

In addition, some consideration must be given to whether the institutional variables highlighted in the cases will be appropriate for addressing the institutional questions of interest. The selection of cases should be guided by theory and there are several traditions that may be drawn upon to develop theoretically rich institutional questions. Economists, for instance, have begun to broaden their focus beyond examining comparative performance of well specified private property rights in water to identifying and examining the efficiency effects of key institutional features, from different water allocation rules (Bennett *et al.*, 2000), to examining the effects of specific legal, policy, and administrative arrangements on the performance of water organizations (Saleth and Dinar, 1999). Legal scholars have just begun to attend to questions of concerning the challenges of incorporating watershed level and ecosystem level governance in the existing framework of U.S. environmental laws and regulations (Karkkainen, 2002). The multidisciplinary field of common pool resources offers numerous hypotheses, from the interaction of different resource features on self-governance, to the effects of the larger economic and social context on local governance of common pool resources (Ostrom *et al.*, 2002). Or, more specifically, the Natural Resources Law Center has produced a series of descriptive studies of watershed initiatives that raise a number of interesting issues, such as the comparative performance of traditional and collaborative management approaches, the effects of consensus decision

making on the quality of decisions, and actions that may be taken to improve the performance of watershed collaborations (Natural Resources Law Center, 1998; Kenney, 2000; Kenney *et al.*, 2000). A considerable challenge for comparative institutional work on water is not a lack of cases, but the wealth of theoretically compelling, policy pertinent questions that beg for careful testing.

Studying Cases Where Water Policy Reforms Are Being or Have Recently Been Attempted – Institutional arrangements play multiple roles in water management practices, as in other human endeavors. One role is of rules in use, guiding well established or even routine patterns of action or interaction. Such rules in use shape water management choices such as whether or not a water provider is able to acquire excess surface water for underground storage in a conjunctive management project, or whether or not a water provider may readily access water stored underground. Institutions guide day to day activities and choices.

Institutional arrangements also shape the decision situations that people face as they contemplate changing their day to day actions or interactions, and as such constrain or facilitate what people can do to adopt and implement new water management practices.

How institutions structure and constrain potential water management actions and strategies provides opportunities to gain substantial advances of knowledge concerning the influence of institutions. Comparative studies of situations in which changes in water management activities (e.g., conjunctive management, water reuse, water transfers, watershed management, etc.) are being or have been attempted can maximize researchers' opportunities to capture whether, why, and how institutional arrangements affected people's ability to accomplish management reforms. The study of conjunctive water management practices looked across states and within states at different points of water policy reform to assess such impacts. Recent institutional changes in Arizona, for example, establishing rights to ground water in Active Management Areas, ensuring rights to store and recover artificially recharged water in these regions, and creating state sponsored organizations to facilitate the acquisition and delivery of surface supplies for recharge have most certainly facilitated the proliferation of conjunctive water management programs across Arizona's municipal and agricultural users over the past decade.

This is the understanding of institutional effects that researchers in the water resources field need to clarify more often. A number of policy recommendations, particularly for improving water use efficiency,

have been reiterated for decades in the professional literature (Ingram *et al.*, 1984; Lord, 1984; El-Ashry and Gibbons, 1986; Reisner and Bates, 1990; Livingston, 1993; Anderson and Snyder, 1997; Haddad, 2000). This literature is valuable for promoting improved management techniques, but only occasionally addresses more squarely the choices and implications of institutional arrangements. Thus, this literature helps us understand the importance of institutions, but does not go far enough in explaining what institutional features work well under different settings or how certain rule arrangements are shaped by particular environments.

It is necessary to understand better, deeper, and more thoroughly, through comparative analyses of existing institutions, how water laws, rules in use, and management organizations aid, hinder, and alter the adoption of water policy reforms – which are themselves changes of institutional arrangements. Such an improved understanding would represent a significant advance toward the broader goal of understanding institutions and their effects in water resource management generally.

Attending to the Levels of Action – As the preceding point states, understanding institutions necessarily and importantly includes understanding institutional change. A methodological point that arises at this juncture is the significance of consciously and deliberately incorporating the notion of “levels of action” (Kiser and Ostrom, 1982) into comparative institutional analysis. This is critical to advancing the understanding of institutional arrangements generally in the water resources field and of user created organizations in particular.

Institutional arrangements function at an operational level of action to guide the ordinary actions of individuals and organizations primarily through determining which actions are allowed, required, or forbidden at which junctures for which categories of individuals. But these operational rules are themselves made at another, collective choice level of action, where a different set of rules specifies who may undertake rule changes and what sorts of changes are allowed, required, or forbidden under different circumstances. Those collective choice rules are set at a constitutional level of action.

The levels of action concept makes explicit the recognition that institutional rules do not merely exist and guide individuals’ behavior, but also may be changed (and even the rules about who can change the rules can be changed). Awareness of the possibility of action beyond the operational level can help institutional researchers move beyond mere assessments of the effects of existing rules – assessments that treat the institutional rules in use at a particular

time and place as “given.” Getting beyond the “given”-ness of institutions is essential for understanding how institutional arrangements really work, since people’s reactions to and cooperation with rules and organizations will often reflect their perceptions of the processes by which those rules were adopted or could be changed.

For instance, for over 150 years in Colorado the contents of the prior appropriation doctrine and its implementation have been developed by water rights holders working closely with water courts. Rules concerning diversions, beneficial use, and transfers, among many others, have been devised and revised as water users challenge one another and attempt to protect their rights in the context of a water court – a collective choice arena. Among water users, water courts are viewed as the legitimate collective choice arena for devising water rights and rules. This became especially apparent after the Colorado legislature granted the State Engineer the authority to devise water regulations. In other words, the Engineer was granted the authority to engage in the collective choice activity of rule making. The first time the Engineer used this authority water users immediately challenged the rules in water court. Eventually, the Colorado Supreme Court ruled that the Engineer indeed had the authority to devise rules but had improperly exercised that authority (Vranesh, 1987). Since that finding, the State Engineer has worked more closely with water users in the development of rules and submits those rules to the proper water court to be adjudicated (Simpson, 2002).

The levels of action conception is particularly important for research on user created organizations. Absent an awareness of the levels of action, it is difficult to make sense of user created organizations in the water resources field or in other aspects of life. User created organizations just seem to appear (or perhaps are “induced” by resource conditions), and researchers may see the prospects for organizational innovation or change lying only outside the user group itself – as having to come from larger jurisdictions, for example. Keeping the levels of action in mind when designing institutional research in water resources is a way of reminding oneself to look upon the origins and transformations of institutional arrangements as matters of deliberation and choice that may have been undertaken by the users themselves (or by or in concert with others), which provides a different sort of understanding of institutions’ and the users’ roles in the management of the resource (Blomquist, 1992; Ostrom *et al.*, 1994). Indeed, without the concept of levels of action the oft-mentioned notion of “governance” in water resources is likely to be murky and mis-specified at best.

Minding the Intergovernmental Relations

Context – Levels of action are not the same as levels of government. Levels of action center on rules and rule making activity, which can occur in a single organization or across multiple organizations. Levels of government center on local, regional, state, federal, tribal, and international organizations and the relationships among them. Intergovernmental relations are sets of institutional arrangements that further define who can do what under which conditions. Such relationships often contribute mightily, but in non-obvious or overlooked ways, to water management practices. Researchers undertaking institutional studies in the water resources field would do well, then, to be sure to take account of the intergovernmental relations context of the settings of their studies.

Intergovernmental relations are at the core of many significant institutional changes that have redefined the water landscape over the past two decades in the U.S. Federal agencies are both more and less central to numerous water issues. The federal water agencies such as the Bureau of Reclamation and the Army Corps of Engineers have seen their construction budgets decline precipitously over the past two decades. Both agencies have struggled to redefine their roles and their relationships with other governments and agencies in the federal universe. Conversely, federal agencies such as the U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service administering major environmental legislation find themselves more involved in water issues.

States, too, have found their water roles expanding as water settings rapidly change. Historically, states and states' water laws have governed the allocation and use of water within their borders, but now states are increasingly active in interstate water transfers. While some states are actively searching for water outside of their borders, others are attempting to protect their waters from being transported to other states. States have also become more active in water quality issues as they take on the permitting processes defined by federal water quality acts. But just as states are expanding their water powers and activities they are also realizing the limits of their authority. For instance, Indian tribes have begun asserting their claims to water and enforcing their water rights against states and nontribal water users. Indian water claims have revealed the neglect on the part of states and the limits on state authority to reign in non-Indian water uses. States' authority to adequately manage water within their boundaries has also been challenged by actions to enforce river compacts. Some states, such as Colorado, have begun to realize that they can only meet their compact obligations if

they work closely with local water users to bring water use within the limits set by compacts.

Furthermore, local citizens are pushing against states and federal agencies to open governing spaces for themselves. Collaborative efforts around watersheds, forests, and other ecosystems are rapidly emerging as resource users search for alternatives to the command and control approaches of federal environmental laws (Kenney and Lord, 1999).

While it is virtually impossible to identify a compelling water issue or setting that does not include an intergovernmental component, intergovernmental relations and interactions are worthy subjects of research in and of themselves. Recent changes involving California's use of Colorado River water provide an example. Although much attention has been focused on the direct water management effects of those changes, they are unfolding in a context shaped by federal/state, interstate, and state/local relations. The U.S. Department of the Interior (DOI) mandated California to devise a plan by December 31, 2002, to reduce its use of Colorado River water by about 800,000 acre feet a year. California had been using as much as 20 percent more than its allocation of Colorado River water, a practice begun long ago when Arizona and Nevada were not yet using their full allotments. California's preparations for reducing its reliance involved some conjunctive management and water transfer agreements among local entities, the most controversial of which was the proposed transfer of about 200,000 acre feet per year from the Imperial Irrigation District to commercial and residential users in San Diego for 75 years. Some Imperial Valley farmers felt that the water transfer price was too low, other opponents felt that reduced irrigation would cause increased dust pollution in the valley, and others feared the liability consequences of reduced irrigation runoff to the Salton Sea. A breakdown in negotiations over this transfer made it impossible for California to comply with its deadline for the plan.

In response, the Secretary of the Interior took the unprecedented step of cutting allocations to California by nearly 600,000 acre feet per year, a large portion of which was taken from the Imperial Irrigation District's supplies. Imperial Irrigation District sued the DOI, arguing for restoration of its portion of the cuts. The state of California, the federal government, the other six Colorado River states, and the local water agencies scrambled for months to piece together another deal. In the fall of 2003, the parties finally negotiated the Quantification Settlement Agreement, which includes the San Diego/Imperial transfer, once assurances had been received concerning Salton Sea preservation efforts and additional financial support for water conservation measures in the Imperial Valley.

The relationships among the various local, state, and federal agencies in this recent battle are clearly important for understanding the operational and organizational outcomes that will ensue. Researchers interested in comparing the institutions governing the Colorado River basin with other multi-state basins should pay close attention to these intergovernmental arrangements.

Topics for Further Institutional Research in Water Resources At This Time

There are several important institutional topics in the water management field that appear to be ripe for intensive comparative empirical research. As each is described briefly, some research questions that institutional analysts could pursue are suggested.

Property Rights and Water Policy Reforms – There have been plenty of conceptual and analytical treatments of property rights issues with respect to natural resource management generally and water in particular. Somewhat less common have been comparative empirical studies of the effects of differences in water use rights on water management practices, water policy reforms, and outcomes. The actual relationships between property rights and water policy reforms (such as conjunctive management, watershed management, water markets, and water reuse) strike us as especially worthwhile at this moment, because there are some abstract propositions in the literature that comparative empirical research may help clarify.

On the one hand, many scholars expect that incomplete or poorly specified property rights will inhibit water users' investments in beneficial and cooperative projects, including conservation. Water users who doubt their ability to capture the benefits of restraint or investment will be less likely to make sacrifices in the short run for longer term sustainability. Furthermore, with specific regard to conjunctive management, dual or multiple property rights systems – such as one set of rules for surface water and another for ground water – increase the transaction costs of reaching agreements among water users and implementing projects. Empirical studies of water markets concur, suggesting that complex water rights regimes can play an important role in raising the transaction costs for water storage and transfer (see e.g., Howe, 1997; Haddad, 2000).

On the other hand, some of the literature on ecosystem management and complex adaptive systems has contended that use rights which are specified too rigidly (e.g., fixed quotas) may be a barrier to the sort of adaptive management best suited to

complex systems under conditions of uncertainty (Wilson, 2002; Rose, 2002). Water policy reforms such as conjunctive management and integrated watershed management require a certain amount of flexibility within and among water uses over time as conditions change. Among the most productive conjunctive management projects studied, for example, were ones where water managers could switch relatively easily (and could encourage water users to switch relatively easily) between surface water and ground water in order to maximize availability, minimize cost, and respond to changing resource conditions.

These differing ideas concerning the impacts of property rights systems on the implementation and success of certain water policy reforms suggest to us that the examination of property rights and their relation to such reforms is an area ripe for further comparative institutional analysis. The interesting questions are already out in the open in the analytical literature. To articulate more helpful and better supported policy recommendations concerning property rights reforms, it is necessary to know what actual experiences can offer.

Organizational Fragmentation and Coordination – There can be little question that water resource management responsibilities are divided among and exercised by several jurisdictions, even within a location such as a metropolitan area or a watershed. Most commonly remarked is the fact that water supply management and water quality protection are typically handled by separate organizations, but that is hardly the end of it. Ground water management and surface water management are separated in many locations, as are water and wastewater management, land use and water management, public health and water management, and environmental protection and water management.

In the water resources literature, however, these organizational separations are typically addressed either through generalized condemnations of fragmentation and calls for integration (e.g., Loucks, 2003; Stakhiv, 2003), or through anecdotes about how some particular aspect of water resource management worked out (or did not) in a particular community at a particular moment. Another forum in which such matters are addressed spasmodically is in "Little Hoover Commission" reports, which often amount to little more than cataloging of the numbers of agencies that exist, followed by critical remarks about how untidy all of this is. Predictable policy solutions often follow: integrate all aspects of water management, preferably at the watershed level (Natural Resources Law Center, 1998).

What is needed, and largely missing to date, is comparative and empirical analyses of actual settings with varying degrees of institutional and organizational diversity. The purposes of such studies would be to penetrate to empirical questions such as: (a) whether and how diverse organizations relate to and represent different constituencies; (b) the extent and effectiveness of communication, information sharing, and coordination among organizations with water-related responsibilities; or, conversely, (c) how much conflict occurs among them; and finally, (d) whether more integrated systems perform better. Such studies require recognition of the functional distinctions among organizations in addition to their geographical overlap. In other words, whether two or more water-related management functions are sufficiently distinct in terms of needed skills and expertise, economies of scale, etc., that the benefits of specialization outweigh the incremental costs of interorganizational coordination. Heikkila (2001) has made a serious effort to tackle some of these topics with respect to conjunctive management in a number of settings, and Easter and Hearne (1995) provided an assessment of decentralized arrangements and efficiency in a number of contexts, but there are few other examples to point out. The authors are convinced that the data for such studies can be gathered and analyzed, and the studies themselves could produce timely and beneficial results that would aid water resource professionals in moving beyond abstractions and anecdotes when they discuss organizational issues.

User Created Organizations in the Watershed

– As the National Research Council report recommended, the entire issue of user created water resource organizations warrants a great deal of additional institutional research. There are a number of questions about user created organizations that are worth asking and pursuing through institutional research.

There is the question of the collective action barriers that must be surmounted in order for such organizations to come into existence, which can be studied across enough cases at this point to develop some interesting and worthwhile knowledge on that score. A related question involves the role of other jurisdictions (particularly larger jurisdictions such as a state or national government) in allowing, promoting, or even mandating the creation of user organizations (Natural Resources Law Center, 1998). Since many user created organizations are nongovernmental (water user associations, watershed forums, etc.), the question of how nongovernmental organizations can and do perform governance functions would be worthy of pursuit and likely to yield interesting findings.

Last but not least, and closely related to the topic of “Organizational Fragmentation and Coordination,” there is the matter of interorganizational and/or intergovernmental arrangements – whether and how user created organizations relate to other existing private and public organizations connected with water resource management in particular settings.

The field of watershed management presents especially strong opportunities currently for the study of the questions above concerning user created organizations. Lubell *et al.* (2002) recently reported analyses of data on watershed partnerships in the United States, with a particular focus on the conditions under which the barriers to collective action in the formation of such partnerships were overcome. Moore and Koontz (2003) offer a classification of types of watershed groups based on their principal membership and suggest that different types of groups have different primary goals or orientations. These studies demonstrate the ripeness of this field of inquiry. Comparable or followup studies could zero in on questions such as the influence of state and/or federal incentives on the established of watershed organizations and whether watershed organizations that were formed with (or in response to) state or federal funding have fared any differently than organizations established independently of such incentives. The Natural Resources Law Center has provided an invaluable handbook for researchers who are considering exploring these issues (Kenney *et al.*, 2000).

Questions such as these, in addition to the questions of nongovernmental governance arrangements and interorganizational arrangements, are ripe to be explored in the watershed context right now in the U.S. The answers could provide a strong addition to the field of institutional research in water resources at the outset of the 21st Century.

Public Participation, or Water User Participation

– The watershed management and ecosystem management literatures, the water reuse and risk perception literatures, the water conservation and water use efficiency literature, share a common and consistent theme – the importance of public participation generally, or water users’ participation in particular. The authors do not doubt the underlying logic that urges the importance of participation. But any time such a prescription is being stated, repeated, and taken for granted, it seems to be the role of the contrary researcher to ask some questions.

The public participation/user participation mantra fairly cries out for some comparative empirical research. It is worth asking, for knowledge’s own sake and for the practical benefits of informing water management practices, whether and in what ways participation makes a difference. Such questions are being

explored by examining different processes or mechanisms used to include public input into environmental decision making (Allen, 1998; Wernstedt and Hersh, 1998). A rich, primarily single case study literature has emerged that examines: (1) participants' perceptions of fairness (Lauber and Knuth, 1999; Selin and Carr, 2000); (2) specific factors, such as resources, on the efficacy of citizen participation (Busenburg, 2000); and (3) the performance of different participation methods in terms of specific outcome measures such as participant understanding of the issues, or the quality of environmental plans (McComas and Scherer, 1999; Burroughs, 1999).

This case study literature has provided a solid foundation for understanding the different forms of public participation. What is largely missing are institutional considerations, particularly how the larger institutional context affects public participation processes (Burroughs, 1999), and how public participation processes affect water management outcomes and the sustainability of institutional arrangements themselves. Such approaches stand good chances of offering some research basis for maintaining and expanding or for questioning, the ubiquitous emphasis on public and user participation.

CONCLUSION

Twenty years ago, Ingram and colleagues published an article titled "Guidelines for Improved Institutional Analysis in Water Resources Planning" (Ingram *et al.*, 1984). The motivation for the paper was the dearth of institutional analyses undergirding most water resources planning and evaluation efforts (Ingram *et al.*, 1984, p. 324). The authors identified and illustrated, using water development examples, the steps and factors involved in conducting rigorous policy analyses (Lasswell, 1971; DeLeon, 1997). Analysts must clearly define the problem, the actors and their stakes, the various resources that actors have at their disposal to attempt to protect and realize their interests, the various decision arenas and their accessibility and biases towards different actors, and the strategies that actors may use in realizing their interests. Such analyses are likely to provide more complete explanations of problems and the effects and consequences of different policy solutions, such as various market mechanisms, changes in water laws, changes in federal water management practices, and so forth. Most importantly, the authors argue, such hard nosed assessments will make important contributions to improving water governance because they

will explain "how human beings are likely to behave and not how we might hope they would behave" (Ingram *et al.*, 1984, p. 333).

Today, this policy analysis approach is reflected in the institutional analysis efforts of water economists Saleth and Dinar (1999). Their motivation is similar to that of Ingram and colleagues: to address the "lamentable dearth of understanding on the issue of how to affect water institutional change" (1999, p. vii). They propose an analytic framework that echoes the guidelines developed by Ingram *et al.* (1984). Saleth and Dinar (1999) carefully identify legal, policy, and administrative features common to most water settings, the relationships among these features, and how they affect the performance of water organizations. The framework, much like the Ingram *et al.* (1984) guidelines, is meant to assist analysts in designing more effective water management policies. Also see Kenney and Lord (1999) for a natural resources framework that is based on the work of Kiser and Ostrom (1982) and Ostrom *et al.* (1994).

The methodological and substantive recommendations made in this paper build on, but are distinct from, the work of Ingram *et al.* (1984) and Saleth and Dinar (1999). Guidelines or a framework that analysts may use to engage in high quality institutional analyses are not provided herein; that work has already been capably done. The starting point for this work begins, in some sense, where the guidelines and frameworks end. A capacity to engage in rigorous institutional analysis is assumed. The suggestions herein attempt to direct that capacity to particularly rich institutional questions using appropriate methodological approaches.

Kenney and Lord (1999, p. 99) note that there is "a growing desire among many parties in the natural resources community to bring a greater level of scientific scrutiny to the description, analysis and, ultimately, the design of institutional arrangements." The focus here has been on a few methodological and substantive topics that the authors think bring a greater level of scientific scrutiny to the design of institutional arrangements and that could yield useful results at present to help us redress the National Research Council's concern that the nation has not been "learning as much as we might" from current experience. Even the few topics suggested herein represent formidable additions to the agenda for institutional research in water resources.

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