

## **Examining the Interaction Among CPR Governance Principles: Boundary Problems, Collective Choice and Conflict Resolution in Interstate Watersheds**

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## PROJECT SUMMARY

The goal of the project is to advance the institutional literature on the governance of common pool resources. It will explore the interactions among boundary definition, collective choice processes, and conflict resolution mechanisms and how those interactions affect the durability of common pool resource governing arrangements. In doing so, this study can bridge theoretical insights from a theory of common-pool resource management with Scharpf's (1997) institutional analysis framework to better understand the structure of institutional decision situations and how those structures address the resolution of collective resource management problems.

The value of this study to common pool resource scholars is that it provides rigorous testing and modeling of some of the principle factors associated with resource management success. Scholars of the commons have begun to build a rich and well-established set of criteria associated with the success of resource management, but do not have empirically tested models to explain how these criteria interact. We focus our analysis on the foundational nature of boundary issues to resource management. The CPR literature finds that well-defined boundaries are associated with successful self-governance. But boundaries are not easy to define and are subject to change. Thus, boundary issues are likely to confront resource users repeatedly over time. We argue that it is necessary to understand the variance in collective choice settings that are likely to support the resolution of boundary problems and how conflict resolution supports those factors. We consider these issues from an inter-governmental context, or one which looks at how the larger institutional setting supports appropriator decisions.

The research setting we propose to test our hypotheses is a comparative study of interstate river compacts in the United States. Interstate river compacts all have clearly structured collective choice and conflict resolution procedures that are easily identified through institutional analysis. Moreover they are designed to address boundary problems and resource distribution issues associated with those boundaries. Finally, they occur within an intergovernmental context that is similar in that all compacts are shaped by state water rights regimes; but these regimes can vary widely. The larger institutional setting governing compacts can shape boundary issues, as well as how the structure of compacts' collective choice arenas and the opportunities that exist for resolving disputes.

This study will contribute not only to the development and expansion of common pool resource theory but also to a better understanding of how cross-scale linkages condition the relationships among key institutional variables – and thus collective outcomes. In addition to theoretical development, this study will offer practical management insights on the institutional design and performance of interstate river compacts, many of which have and will continue to face disputes over their allocation rules as water supplies become more strained. We expect these findings to provide a well-grounded and empirically supported model for analyzing and understanding a variety of other resource management institutions.

## PROJECT DESCRIPTION

### I. Introduction

One of the burgeoning areas of scholarship that crosses political science, economics, and sociology is the study of institutions and the effects institutions have on individual and collective decision-making. Research on common pool resource management is widely recognized as offering significant theoretical contributions to institutional theory (Sabatier 1997; Scharpf 1997; Peters 1999; Jones 2001; Young 2002a). This body of research is largely concerned with understanding how individuals devise institutions governing scarce resources, such as fisheries, water, and forests, and with the characteristics of resource management institutions that are most successful.

The field of common pool resource management has matured over the last two decades (Stern, Dietz et al. 2003). Initially, the field was characterized by confusion over the very definition of common pool resources (Ostrom 1990; McCay 1996). Scholars also had limited models for explaining how people use and interact within common pool resources, which primarily assumed that people were incapable of self-governance and their use of common pool resources would end in tragedy without strong external intervention. After considerable empirical evidence emerged contradicting these models, scholars have now devised extensive typologies of rules and characteristics of common pool resources that affect self-governance and sustainability. The vast studies confirming these characteristics, in both field and laboratory settings, indicate that this research program is healthy and active.

The most critical tasks presently facing researchers are theory development and testing (Agrawal 2002; Stern, Dietz et al. 2003). Agrawal (2002) argues that too much attention is still being devoted to the identification of factors that support self-governance and sustainable use of common pool resource, so much so that researchers face an almost embarrassing wealth of factors. Agrawal (2002: 62-63) has identified 33 distinct factors that scholars argue account for success. One problem with the list of factors is that they alone do not explain success or failure in common pool resource management. Rather, the factors are configurational, they interact, and through that interaction outcomes are realized. To date, however, little attention has been devoted to identifying or exploring the interactions among the factors – that is, to use the factors as a means to develop theory. Second, the factors rarely apply uniformly across all common pool resource settings. The values that the factors take and their effects on an outcome are influenced by the larger context within which the common pool resource is situated. The factors are contingent on a variety of contextual variables. Thus, the task facing researchers is to engage in the careful and systematic development of theory by developing causal models to “narrow the range of relevant theoretical variables” (Agrawal 2002: 68) and test those models through carefully designed research projects. We propose to do precisely that.

In particular, we plan to explore the interactions among boundary definition, collective choice processes, and conflict resolution mechanisms and how those interactions affect the durability of common pool resource governing arrangements. Furthermore, we will

explore the effects of a specific set of contextual variables on the interaction of these factors – those of intergovernmental relationships. We choose these factors because of the many studies that have noted the centrality of collective choice processes and conflict resolution mechanisms in the success of common pool resource institutions. Second, these factors are foundational issues within political science and institutional economics. Third, Stern et al. (2002) in a review of common pool resource research over the last two decades identify key understudied issues, among them being conflict resolution mechanisms and cross-scale linkages among organizations, including intergovernmental relationships.

## **II. Interaction Among Principles of Long-Enduring CPR Institutions**

The literature on common pool resource (CPR) management is largely grounded in the institutional analysis and development framework, articulated most notably by Ostrom (1990; 1999). Institutional analysis focuses on in-depth comparisons of the structure of institutional arrangements, as well as the physical and community setting within which those institutions operate, to explore the effects of institutions on human choices. Ostrom's seminal work, *Governing the Commons*, (1990) used this framework to develop a set of design principles that characterize successful, long-enduring common-pool resource institutions.

Boundaries are the focus of Ostrom's first institutional design principle of long enduring, self-governing institutional arrangements (Ostrom 1990). It is the first design principle because, as Ostrom (1990:91) points out, individuals are unlikely to attempt to engage in self-governance if they do not know "what is being managed and for whom". Settling on the boundaries of the resource and of the resource users provides the basis for engaging in resource governance. Well-defined boundaries of the resource and of the resource users allow users to capture the benefits of their investments in governing arrangements and in the resource (Ostrom 1990; Libecap 1994). Thus, well-defined boundaries motivate self-governance. Why bother to invest in rules, or in their monitoring and enforcement, or in dampening conflict among resource users, but for the promise that the benefits of doing so will redound to those who made the investment?

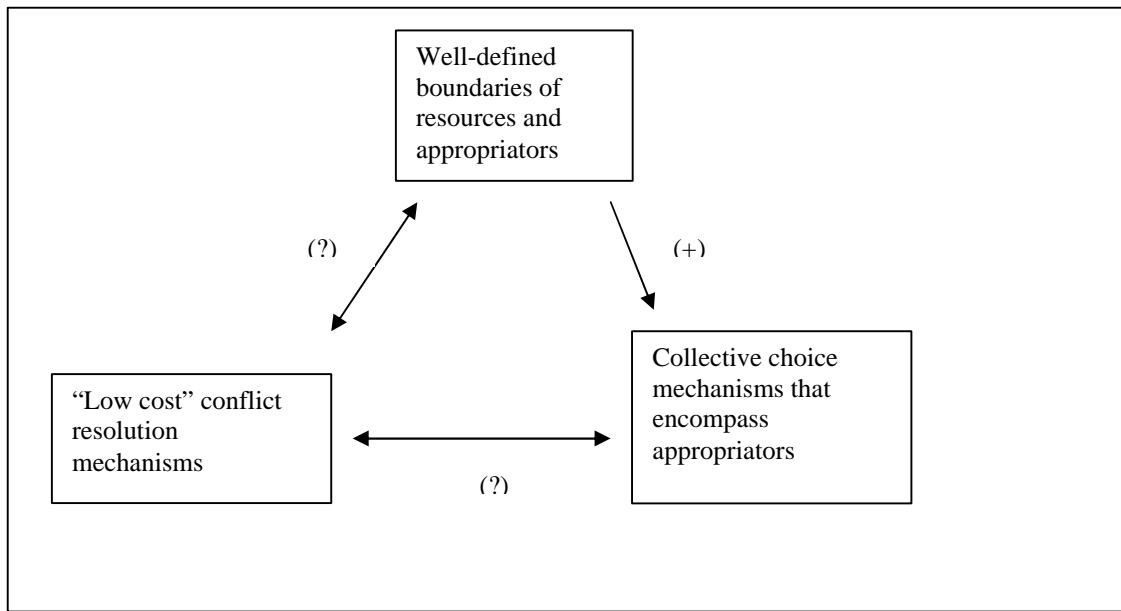
Ostrom (1990) argues that well-defined boundaries provide positive incentives for appropriators to participate in rule making, or collective choice activities because they ensure that appropriators will benefit from investing in governing arrangements. More durable and successful governing arrangements are likely to result from the active participation of appropriators in devising rules that govern access and use of resources (Ostrom 1990; Baland and Platteau 1996; Wade [1988] 1994). If rule makers are subject to the rules that they devise, they are more likely to attempt to carefully match the rules to the physical and social setting so that the rules allow them to better realize their goals. Furthermore, they are aided in developing carefully matched rules by the local time and place information that they possess.

The success of collective choice forums is predicated on the notion that decision-makers and resource users will more likely follow the rules they establish for themselves. Rule

following behavior will be greater and more robust in settings in which most appropriators participate in collective choice processes (Tang 1992; Lam 1998). Conversely, rule following behavior is likely to be more problematic when important subgroups of appropriators are forbidden or prevented from participating in rule making (Agrawal and Gibson 2001). Resource users, at various points in time and for a variety of different reasons, will be tempted to break the rules, even if they actively participated in rule development. Disputes may arise over a whole host of issues – from withdrawal or use issues (did an irrigator take water out of turn, or did a fisher use banned technology) to boundary issues (did a person meet all of the qualifications to become an appropriator, or is a groundwater aquifer part of a river basin).

Inevitably people break rules or conflicts emerge over the interpretation of rules. Such conflict can be destructive, threatening the existence of self-governing arrangements. As Ostrom (2001) notes, if “disagreements are not resolved in a low-cost and orderly manner, then appropriators may lose their willingness to conform to rules because of the ways that other interpret them in their own favor” (Ostrom 2001) . If, however, resource users have ready access to accepted or legitimate arrangements that allow them to process and settle their disputes relatively peacefully, then rule following behavior is supported. Rules come to have a common meaning and rule compliance is encouraged. Having “low cost” conflict resolution processes has thus become a key principle of long-enduring CPR management (Ostrom 1990).

As Agrawal (2002) has argued, specific relations among the factors thought to contribute to durable, self-governing arrangements have not been identified, and that is certainly the case with boundaries, collective choice processes and conflict resolution. While it is clear that the three variables support one another and interact, how they do so is less clear. The only specific relationship that has been suggested is that well-defined boundaries support appropriator participation in collective choice processes. As argued above, well-defined boundaries allow resource users to capture the benefits from investing in rules to govern their use of a CPR. Thus, the relationship is a positive one: rules that clearly define boundaries are positively correlated with appropriators as rule makers and with successful long term, local level governance (Schlager 1994; Wilson et al., 1994), whereas poorly defined boundaries are associated with institutional failures (Ostrom 1990). The following figure illustrates the relationships posited among the factors:



### *Clarifying Causal Relationships Among the Variables*

The model presented above presents boundaries as a causal mechanism supporting collective choice mechanisms that involve appropriators. Here we look more specifically at the variation in boundary issues as problems facing CPR users, and then examine how variance in collective choice and conflict resolution institutions will affect the resolution of those boundary issues. Thus, boundary issues are seen as dependent variables. We then consider how specific conflict resolution arenas play a role in this process.

The assumption in the CPR literature is that institutional actors can identify and enforce well-defined boundaries around resources. In practice, boundaries are often highly problematic. They are not fixed over extended periods of time and they do not simply exist out there in the physical world to somehow be discovered. Boundaries are dynamic – people probe, challenge and change them. In some instances boundaries are called into question because resource users and/or scientists come to a better understanding of a resource and how different dimensions or features interact. For instance, over the last several decades, hydrologists and water appropriators have come to recognize the interconnections between rivers and groundwater basins, calling into question boundaries that fail to recognize such connections. In other instances, boundaries are called into question because of human activity that breaches boundaries and connects previously unconnected activities or resources. The citizens of Denver and Los Angeles rely heavily on water from the Colorado River Basin even though neither city resides within the basin. Should the boundaries of the basin reflect the fact that the development of large surface water projects has connected previously unconnected resource users? Finally, not only do seemingly fixed physical boundaries change over time, but so too do boundaries that define appropriators. For instance, western states have administrative mechanisms and requirements that define water rights holders and the constitutional protections for their

rights. The group of individuals with rights to access and use water thus fluctuates over time.

The range of potential boundary issues can create dilemmas for CPR users because rules that they impose at one period of time may not appropriately address the changing physical or social conditions. Collective choice mechanisms may allow appropriators to respond to the dynamic nature of boundaries. One of the reasons that collective choice processes are included as a design principle is that they provide opportunities for adapting rules to changing circumstances. Appropriators can bring to bear their experiences with existing rules and their knowledge and understanding of resource conditions to revise rules to better match new circumstances. Much of the commons research addressing collective choice issues has emphasized the importance of participation by appropriators in rule making on the types and performance of the rules adopted (Tang 1992, 1994; Lam 1998). For instance, research that has compared the performance of institutional arrangements devised by government officials to those devised by appropriators finds that appropriator defined governing arrangements perform better (Tang 1992, 1994; Lam 1998). This research thus expects that collective choice processes that include appropriators as critical participants will better respond to changing boundary conditions than will collective choice processes that do not include appropriators.

These findings are far from widely accepted. One feature that differentiates the CPR literature from the larger environmental policy literature is the characterization of appropriators and their roles in governance. In the former, appropriators are viewed positively – resource users must participate in resource governance for it to be successful. In the latter, appropriators are viewed with considerable suspicion as the primary causal agents of environmental problems. Granting resource users a central role in governance is tantamount to giving them permission to misuse resources as they please (Kenney 2000).

What has not been explored in either literature is how the structure of collective choice conditions the participation of resource users. The participation of resource users per se does not spell success or failure of resource governance; rather, it is how that participation is structured. Thus the relationship between collective choice mechanisms and the resolution of boundary issues is also dependent upon the variation in collective choice structures. The vast social choice literature suggests that the structure of collective choice arenas matter for whose participation most influences rule making; for whether rules will be adopted; and for the types of rules that are created. Whether it is exploring the role of agenda setters (McKelvey 1976), the influence of agenda setting rules; the behavior and performance of the committee structure of the U.S. Congress (Kiewit and McCubbins 1991); single party and multiparty systems; the performance of bicameral and unicameral legislatures (Tseblis 1995); or the role of vetoes and veto players (Tseblis 2002), the structure of collective choice processes strongly effect participation and outcomes.

The variation in collective choice mechanisms is enormous. Scharpf (1997:47) identifies several “model” collective choice processes, or what he labels modes of interaction,

including unilateral action, negotiation, voting, and hierarchical decision making. How well each type of choice process works depends on the institutional setting within which it is embedded. Unilateral action and negotiation can take place in a multitude of institutional settings, from those involving minimal institutions to hierarchical organizations, whereas voting and hierarchical decision making require more structured arrangements. Voting, at a minimum, requires associations or representative assemblies (*Ibid*). Hierarchical decision making requires hierarchical organizations (*Ibid*).

In the CPR literature, most cases of self-governance involve collective choice processes that tend to be minimally structured. Using Scharpf's terminology, they tend to involve unilateral action or negotiation in the context of minimal institutions, networks, regimes, and joint decision systems (Scharpf 1997:46). How well they function to allow appropriators to agree upon a set of rules to govern their use of a common pool resource depends on the nature of the problems appropriators face. Collective choice processes vary in their capacity to address different types of problems (Scharpf 1997). Scholars can use Scharpf's (1997:48) conceptual scheme to examine "the capacity of given systems of policy interactions for dealing with given types of policy problems". In other words, Scharpf's scheme provides an approach for exploring the issue raised above, how the structure of collective choice processes affects resource governance – specifically those problems created by boundary issues.

Scharpf (1997:47) characterizes policy problems by the level of conflict among participants' interests. In some instances conflict is relatively low as participants' are mostly concerned with coordinating their actions to achieve an outcome that all find desirable. In such settings even minimal collective choice processes may successfully address such issues. In other instances conflict may be high among participants as they differ over the distribution of benefits and costs rising from a common enterprise. More structured collective choices processes are more likely to better handle such conflict.

More specifically, Scharpf (1997) develops a typology of negotiation settings. Scharpf (1997:121) argues that negotiations vary along two dimensions – production and distribution. Production involves the creation of value and distribution involves the sharing of that value. The two dimensions are often times closely linked. As Scharpf (1997:121) states, "The creation of value will be impeded unless the acceptable sharing of value is assured." Based on the two dimensions, Scharpf (1997: 126) identifies four different negotiation settings including 1) spot contracts in which the salience of production and distribution are low, 2) distributive bargaining in which distributional issues are highly salient but production issues are not, 3) problem solving in which production issues are highly salient but distribution problems are not, and 4) positive coordination in which both production and distribution issues are highly salient.

Scharpf's distinction between production and distribution has a direct analog with boundary issues in common pool resource settings. The formal definition of a common pool resource is that exclusion is costly and difficult to attain and resource units are subtractable – the portion of the flow of a resource that one appropriator withdraws is not available for others to withdraw (Ostrom and Ostrom 1977). In order for common pool

resources to be governed well both exclusion and subtractability issues must be addressed. In other words, defining exclusion -- identifying who is in and who is not in -- is critical. While defining boundaries is a necessary condition for good governance, it is not a sufficient condition. As Ostrom (1990:92) explains, "Simply closing the boundaries is not enough. It is still possible for a limited number of appropriators to increase the quantity of resource units that they harvest so that they dissipate all potential rents or totally destroy the resource". Thus, exclusion and use in the literature on common pool resources is similar to production and distribution in negotiation settings.

Just as production and distribution, or the creation and sharing of value, are often intertwined, so too are issues of exclusion or boundary definition, and use. Boundary definition determines who is in and who is out among appropriators, or what is in and what is out in relation to a resource. However, negotiating over who is in and/or what is in, often occurs with an eye to how the resource will be used and who gets what. As Ostrom (1999) notes, many boundary rules catalogued from numerous case studies of common pool resource situations are conditioned by certain requirements that impact the use of a resource. For instance, boundary rules for irrigation systems often involve some sort of residency requirement, conditioned by ownership of shares in an irrigators association. Those shares define how an irrigator can participate in an irrigation system (Tang 1992). Or, boundary rules for fisheries often involve a residency requirement conditioned by certain types of fishing technology. Fishers must not only meet residency requirements to gain access, but they must also agree to use certain types of fishing gear (Schlager 1994).

Given our focus on boundary issues, and adapting Scharpf's (1997) typology to our purposes, we are most interested in problem solving settings (where boundary issues, but not use issues, are highly salient), and in positive coordination settings (where boundary issues and use issues are highly salient). According to Scharpf (1997:132), problem solving processes make fewer demands on collective choice institutions than do positive coordination processes. That is not to say that problem solving processes are always successfully handled. It is just that individuals primarily focus on creating value through defining appropriate boundaries without having to attend to use issues as well. Less formally structured collective choice institutions may be able to successfully handle problem solving processes.

Positive coordination processes, on the other hand, are much more difficult to resolve, and thus make greater demands on collective choice institutions. Such processes are much more difficult to navigate as individuals jostle for advantageous use rules while at the same time attempting to define boundary rules. As Scharpf (1997: 134) notes, individuals may be tempted to provide misleading information so as to better position themselves in relation to use. Or, individuals may refuse to support certain boundary rules, even if such boundary rules improve the overall welfare of all appropriators, because of the implications for use that the rules may have for them. Scharpf (1997:135) argues that collective choice structures must be more carefully devised to support the successful resolution of positive coordination processes, and even then failure is likely to be common. As Scharpf (1997:146) concludes:

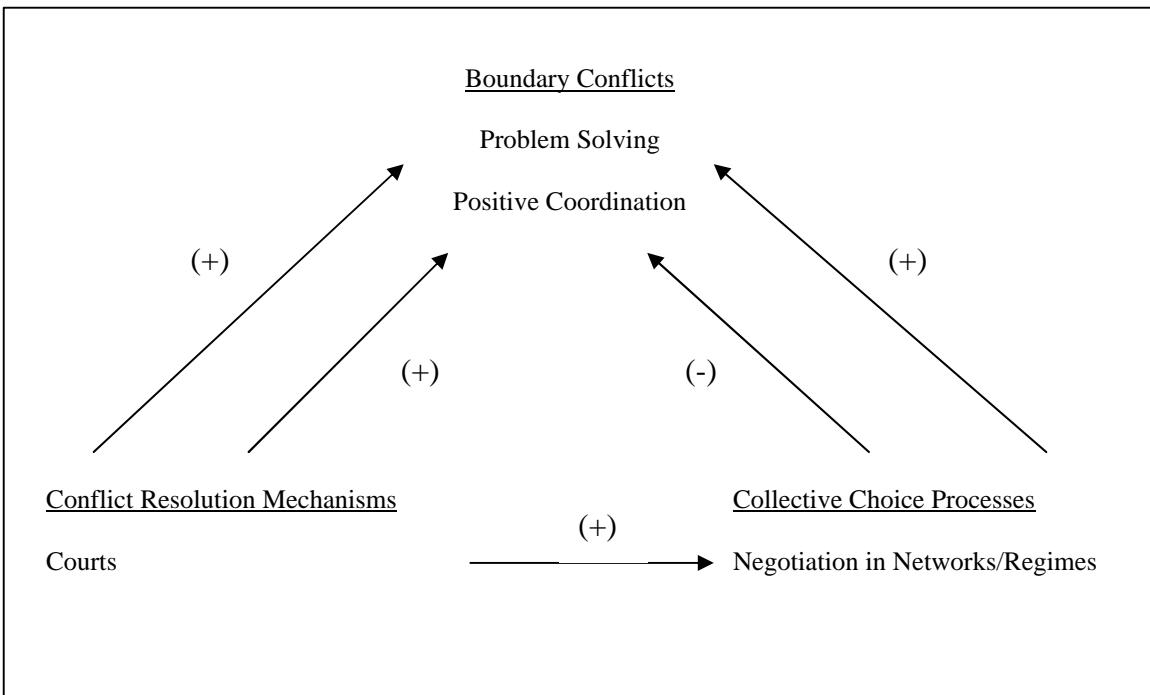
negotiations are ... associated with high transaction costs when distributive conflict must be resolved in the same interactions in which better overall solutions are to be designed or discovered. Hence negotiations will often fail altogether or will merely produce unsatisfactory compromises in which potential welfare gains are “left on the table.”

Representative assemblies that do not use a unanimity rule or hierarchies are more likely to be successful in addressing positive coordination processes (Scharpf 1997). Thus, we expect appropriators, as they bargain and negotiate over boundary issues, to be more successful in addressing issues that do not also implicate use issues. We expect appropriators to be less successful in bargaining over boundary and use issues simultaneously.

Boundary conflicts not only implicate collective choice processes but also conflict resolution mechanisms. As Stern et al. (2002) note, conflict resolution mechanisms have received scant attention in the CPR literature. Furthermore, when they have received attention, primarily by scholars attempting to develop the factors that influence durable, self-governing institutions, attention has only been devoted to a single dimension -- settling conflicts brought before them. However, it has long been recognized that conflict resolution mechanisms also influence collective choice processes. Negotiations may take place in the “shadow” of the courts. That “shadow”, if we may mix our metaphors, acts as a two edged sword. One edge involves a threat that motivates actors to negotiate their own governing agreement. If they fail to do so, the court may impose an agreement on them, one that they may find undesirable. The other edge involves support. If participants in negotiations do come to an agreement, ratification of it by a court provides formal recognition and protection of it. Also, it provides the parties to the agreement a venue in which to enforce the agreement.

Conflict resolution mechanisms also affect boundary conflicts. Conflict resolution mechanisms provide a venue in which to settle boundary disputes, however, their greatest value may be in settling conflicts that involve boundary and use issues. Scharpf (1997:145) argues that one approach to settling production and distribution conflicts through negotiations is to have a disinterested third party who has no stake in the outcome propose solutions. As Scharpf (1997:145) explains, “it may be easier for an external agenda setter to assess the limits of acceptability for all participants and to propose a jointly acceptable solution – if one in fact exists.”

Overall, the model that we propose to empirically test is:



### *Conditioning the Model: Cross-Scale Linkages*

Agrawal (2002) argues that theory development must include the effects of contextual features on factors that affect the durability of self-governing institutions, as discussed above. The contextual features most likely to have direct and immediate effects on the relations among boundaries, collective choice processes and conflict resolution mechanisms are cross-scale linkages, specifically intergovernmental relations. Cross-scale linkages can be thought of as networks of overlapping organizations, which share governance and management authority over a particular resource. For instance, the supply of water in a river can be governed and managed at many levels. A federal agency may have authority over the management of a dam and reservoir system, while state-level institutions might assign and administer the rights to local water users to withdraw water from the river, and a local water management district or irrigation district might control the distribution of an assignment of water to various district members.

The importance of cross-scale linkages, or the relations among organizations across society, has long been recognized, even though little specific attention has been devoted to their study. Cross-scale linkages appear in two separate design principles devised by Ostrom (1990). First, when she suggests that appropriators must have minimal recognition by governmental authorities of rights to organize if they are to develop durable institutional arrangements. Second, when she recognizes that institutional arrangements are more likely to be adaptive and enduring when their rules “are organized in multiple layers of nested enterprises” (Ostrom 1990:90). Cross-scale linkages also appear in the set of attributes of resources and appropriators that support the emergence of collective action as identified by Ostrom (2001). Ostrom (2001) proposes that appropriators possess autonomy from higher levels of government in order to devise their

own rules. Autonomy and rights to organize provide the critical space that appropriators need to engage in collective choice processes.

In addition to affecting collective choice processes, cross-scale linkages implicate boundary issues. As Young (2002b) notes, state and national governments are likely to view and are likely to have different interests in common pool resources than are local resource users. Larger governments may want a wider range of values considered in governing common pool resources than do locals. Or, larger governments may want to pursue interests, such as opening common pool resources to regional or global markets that local resource users may not want to allow. Local resource users, according to Young (2002) tend to operate with a different set of interests in mind (Young 2002b). Locals will attempt to capture and control the benefits arising from the common pool resource for their own use and will resist the efforts of larger governments to control use.

The extent to which the interests and values of appropriators win out over that of higher level governments and vice versa depend on the types and quality of cross scale linkages between local resource users and higher level government officials. If resources users have constitutionally protected property rights in the resource they are much more likely to be able to protect their interests than if they do not have constitutionally protected rights. Constitutionally protected property rights allow appropriators substantial influence over boundary issues. Their protected right to be in the resource provides them with considerable leverage in determining who else can and cannot be in the resource.

Furthermore, the extent to which higher levels of government can influence the collective choice processes of local appropriators depends on the decision making authority that local appropriators have been granted and the extent to which that authority is protected. If the authority is embedded in legislation or in a constitution, higher levels of government will be more limited in their ability to directly affect local level collective choice processes. In order to override local collective choice processes, external government officials will have to change legislation and/or change constitutional provisions. Thus, we intend to explore the conditioning effects of cross-scale linkages on boundary issues and collective choice processes by examining the legislative and constitutional protections that appropriators possess. Such linkages can significantly shape the structure of collective choice arenas that appropriators operate in, and thus how they resolve boundary issues.

### **III. Research Questions and Hypotheses**

The literature and theory review has identified a number of potential ways that boundaries, collective choice mechanisms and conflict resolution rules can interact and offered a preliminary causal model for these interactions. The theory also indicted the importance of considering these interactions within the context of the overlapping institutional arrangements that govern a particular resource. We assume that CPR users have to address changing boundary definition issues, which are sometimes intertwined with use problems. Our research questions focus on identifying how conflict resolution

mechanisms and collective choice arenas affect the ability of CPR management institutions to address these boundary issues.

1. *How do boundary issues, and thus the strategies required for resolving boundary issues, differ across resource settings?* Boundary issues and their resolution (through problem solving or positive coordination) are the dependent variables in our model. As suggested by the literature review, it is important to first identify how boundary and use issues differ across different CPR settings, focusing on production and distribution (or boundary definition and use issues). In doing so we also will examine how the larger institutional setting is associated with differences in boundary problems. We expect to find that much of the variance in boundary issues will depend on the extent to which federal actors play a role in resource decisions relative to local actors. These differences will impose distinct strategies for resolving conflicts – the success of which will depend on collective choice structures and conflict resolution.
2. Once strategies for resolving conflicts are differentiated, we can then ask: *How does the structure of collective choice processes support the resolution of boundary issues?* We expect to find that appropriators are likely to be more successful in addressing boundary issues when they also do not involve use issues (or “problem solving situations”), than boundary issues that involve both distribution and use issues (positive coordination situations). Moreover the larger institutional setting is likely to support the ability of appropriators to address these issues, through constitutional or legislative protections of their right to collectively organize. However, the larger institutional setting also can support the resolution of issues where boundary definition and use are intertwined through hierarchical agreements.
3. *What types of conflict resolution venues are best suited to settling conflicts over boundaries?* While appropriators may have various mechanisms for resolving disputes, we expect that courts will provide the most effective conflict resolution arenas when settling boundary problems that are intertwined with use issues. We will assess both the direct effects that courts have on resolving boundary disputes, as well as the indirect effects they have through their support of appropriator-led regimes.

#### **IV. Research Setting: Interstate River Compacts**

To test the research questions we have laid out, we will conduct a comparative study of interstate river basin compacts. Interstate river basin compacts are self-governing arrangements that states enter into to, which prescribe the quantity of water each state can legally appropriate from a shared river basin. In the Western United States, there are 22 river basin compacts, while eastern states now are beginning to use compacts to govern rivers where flows are particularly strained (Grant 2003), including some federal-interstate compacts (Featherston 1999). Interstate river basin compacts provide an excellent research setting for developing and testing causal models of CPR governance

because they are self-governing arrangements devised and voluntarily entered into by the states; have explicit boundary and use issues, collective choice mechanisms, and conflict resolution procedures; and operate within an intergovernmental setting.

Interstate compacts were devised to address conflicts over the physical extent of the resource available for states to appropriate; in other words they deal with boundary issues. The way in which compacts divide flows can vary, and thus the boundary issues they address also are likely to vary. Some compacts allocate a fixed amount of an entire stream flow across all of the states through which the river passes, while others allocate a percentage of a flow (McCormick 1994). Compacts do not have to apportion the flows of an entire river system, however. A few compacts allocate flows by limiting the amount of water an upstream state can place in storage. The Arkansas River Compact has allocated a portion of the river that flows between Colorado and Kansas using a percentage scheme for water that is available from storage in a reservoir. By establishing limits on the flows that individual states can use from a stream, states then must decide how to meet those limits within the context of the various local appropriators who use the water, such as irrigators, municipalities and special districts. Furthermore, a number of compacts are confronted with the issue of how to draw boundaries in relation to hydrologically connected groundwater basins. When the compacts were originally entered into, groundwater use was minimal and the connections between aquifers and rivers not well understood. Now groundwater pumping is affecting surface water flows, forcing compact participants to reconsider boundaries.

Boundary issues and collective choice issues in interstate compacts are clearly linked in that they must establish who has the authority to make decisions about basin allocation. The impetus for many compacts was in fact to ensure that states, rather than Congress or federal courts, would have ultimate control over allocation decisions (McCormick 1994). The structure of the collective choice arenas established under river compacts can vary. Some compacts assign decision-making authority to commissions, such as the Klamath River Compact. Commissions “generally are similar in terms of the organization and appointment and removal of members, but differ with respect to the powers granted to them” (Zimmerman 2002, 131). Commissions monitor the states’ implementation of compacts and may also devise and revise rules that promote the more effective operation of the compact. A few compacts, like the South Platte River Compact between Colorado and Nebraska, are not governed by a commission. Instead, water agencies in the individual states monitor the implementation of the compact and informally coordinate their actions under the compact.

The structure of the collective choice arenas also affects how compacts can alter rules to address changing boundary issues. For instance, many compacts require unanimity among states when making changes to allocation rules (McCormick 1994), while a few have established 100-year time frames for their duration (Zimmerman 2002). The collective choice mechanisms set forth by compacts also prescribe rules for the resolution of disputes over compliance with compact terms. A few compacts have provisions that require member states to arbitrate disputes, while others require resolution through their respective commissions (McCormick 1994). The conflict resolution rules and procedures

established under a particular compact can differ, depending on the scope of the issue or problem. The range of voting rules can include: majority vote, unanimity, and “casting” votes by an appointed federal member (McCormick 1994). Finally, litigation is another option states have to resolve compact disputes when commissions or member states cannot settle their agreements; the U.S. Supreme Court has jurisdiction in these cases.

These institutional similarities and differences among water compacts provide a useful setting for testing how boundary, collective choice, and conflict resolution rules relate and interact. In addition, water compact institutions have well-defined cross-scale linkages, which provide further evidence for theory testing. In particular, state and local laws governing rights to water resources can play an important role in structuring compact outcomes. For instance, in the 1980s, a boundary dispute erupted between Kansas and Colorado in the 1980s because Colorado’s water rights laws permitted groundwater users to pump water that eventually depleted flows in the Arkansas River, which led to a 20-year Supreme Court battle between the two states.

In addition to providing a useful research setting for testing a model of CPR governance, interstate compacts are ripe for institutional and policy analysis. Legal scholars and economists have begun building a critical literature that focuses on the inefficiencies and inequities of interstate river compacts (Giardot 1989; Hasday 1997; Bennett, Howe et al. 2000; Robbins and Montgomery 2001; Grant 2003), but this scholarship is largely missing an analysis of the policy features of compacts. Although a few scholars have looked broadly at the value of water compacts as policy instruments for managing a shared basin (Hill 1992; McCormick 1994), most of the research on the topic focuses on one particular compact as a case study (Haller 1981; Gilmore 1987) or discuss a compact as part of the larger institutional setting governing a basin. With the exception of recent work by Zimmerman (2002), political and policy scholars have paid little attention to comparative analyses of interstate compacts in general. While Zimmerman’s research on interstate compacts has begun to give us a clearer picture of how compacts structure interstate relationships and cooperation (Zimmerman 1996; Zimmerman 2002), this research does not incorporate a research framework that focuses on the interaction among the institutional features of compacts for resolving collective dilemmas.

#### **IV. Methods**

To test the hypotheses presented in section III, this study will involve four major areas of analysis: 1) investigating the boundary issues that compacts address and have addressed over time, 2) investigating how collective choice mechanisms are defined by compacts and how they are conditioned by cross-scale linkages, 3) investigating the conflict resolution mechanisms that compacts use and 4) identifying the relationships among these three major categories of variables.

Methodologically, the principle investigators are well prepared to undertake this analysis. The principal investigators have extensive training in institutional analysis. Professor Schlager, who graduated from Indiana University under the training of Elinor Ostrom, has been a faculty member at the University of Arizona for over ten years, where her

research career has focused on institutional analyses of natural resources. Professor Heikkila was trained by Professor Schlager and held a post-doctoral appointment at Indiana University's Workshop in Political Theory and Policy Analysis. For the past two years she has been an assistant professor at Columbia University's School of International and Public Affairs. Both professors have a large pool of graduate students in public policy, natural resource management, and political science who can assist with data acquisition and analysis.

The principle investigators also have developed a long research program focusing on water management, which will facilitate the acquisition of data on interstate compacts. From previous collaborative work on water management in California, Colorado, and Arizona, which are parties to 12 compacts, Professors Schlager and Heikkila have extensive familiarity with data on water rights laws and administration in the study population (Blomquist, Heikkila et al. 2001; Heikkila 2001; Blomquist, Schlager et al. 2004). The investigators have begun to compile basic information on all western river compacts and contact information for compact administrators, available from the Council of State Governments.

#### *Data Acquisition*

This project will require extensive data acquisition from primary and secondary sources, as well as a variety of tools to summarize and analyze the data. The first phase of the project, in 2005, will involve gathering primary resources for comparing compact rules. In the spring of 2005, Lexis Nexis will be used to identify and collect compact laws and court cases (and reports by special masters assigned to cases) related to all interstate river compacts. The principle investigators will assign research assistants to review the compacts and related cases to identify the independent variables rules, (collective choice structures, and conflict resolution arenas) and the variance in boundary issues across compact settings. These variables will be coded for each interstate compact and catalogued using Microsoft Access.

During the summer of 2005, the investigators will contact relevant commissions or governing bodies to collect additional data on the ways in which boundary issues have been addressed over time, focusing on why compacts were developed initially and how compacts have been altered. Contact information for all interstate compact administrations is available through the U.S. Council of Governments. Investigators will request access to all documents available on the compact administration, including minutes, annual reports or other records pertaining to compact compliance, and court documents (where appropriate). Investigators will also conduct brief, open-ended interviews with administrators to gather personal knowledge of changes to compacts over time to ensure that document collection is complete.

This project will also investigate state institutions governing water use on the rivers subject to the compacts and the organizations that administer these policies, specifically water rights laws and the organizations that administer those laws. This information is available through Lexis Nexis, secondary research, and existing data from previous

research by the authors. This data will be catalogued using Microsoft Access so that links can be made with the relevant compacts. The principle investigators both have experience developing and running Microsoft Access databases for water management research; Schlager and Heikkila both used this software for prior NSF-funded research on conjunctive water management in the Southwest.

To supplement the institutional data, the project will collect current social and physical features of the river basins governed by compacts, as well as the physical and social conditions in the basin during the time of the compact development as control variables. This will occur in the fall of 2005. Much of this information can be obtained through the review of court cases or commission reports as well as from some secondary sources. In addition to the commissions, state departments of water resources can provide water quantity and quality information on streams, whereas community characteristics can be identified through the U.S. Census, cities and states.

### *Data Analysis*

Given that the number of compacts is somewhat small compared to the potential number of relevant institutional variables of interest, we will employ a variety of analytical methods to test our hypotheses and answer our research questions. This phase of the research will occur in 2006.

First, the 2005 data on all interstate compacts will be analyzed with basic descriptive statistics. The current rule configurations for each compact will be described and compared. The boundary issues that compacts addressed when they were developed will also be described and compared. We will also develop a timeline for each compact that describes boundary issues that emerged over time for a given compact and how different collective choice structures and conflict resolution arenas were used to address those problems.

In addition to the descriptive data, we will also use a method known as Qualitative Comparative Analysis (QCA), which is based on Boolean comparative logic (Ragin 1987). This method compares different combinations of independent variables in relation to a dependent variable, and then simplifies the causal conditions using a bottom-up data reduction process. The benefit of a Boolean analysis for this study is that it addresses the problem of limited observations in this data, which can reduce the explanatory power of quantitative statistical control models. Another benefit of using QCA is that it shows qualitatively how different types of interactions among many independent variables are related to an outcome of interest. QCA identifies the actual cases and the interaction terms among variables in those cases that are necessary or sufficient causes of the dependent variable. For instance we can examine the relationships among different types of rules and whether or not a compact has resolved a particular type of boundary dispute.

Finally, we will develop in-depth studies of a few specific cases, such as some with very complex cross-scale linkages or timely water management conflicts, like the Klamath River Basin, to look for different relationships that do not come up in the comparative

analyses. One way to maximize the information from the case studies is to use N-Vivo software for the analysis. This software is useful for doing qualitative analysis of documents to compare themes, key words and draw relationships. It allows us to quickly and accurately look for key variables in the text of compacts, interviews, and court cases. It can be most helpful in identifying content in these texts that implicate boundary or use issues over long periods of time, or during intense periods of conflict and debate where issues are debated and presented in various media.

## **VI. Broader Impacts and Dissemination of Findings**

The results from this study will be: 1) development and expansion of common pool resource theory; 2) application of common pool resource theory outside of small-scale local settings; 3) better understanding of cross-scale linkages and intergovernmental relations; and 4) institutional design and performance of compacting – especially river compacts.

From a theoretical standpoint, this research will be of use to scholars concerned with understanding the interaction among institutional arrangements that have been positively linked to effective resource management. It is these relationships or interactions that have not been adequately studied by CPR scholars, particularly in complex CPR settings where local resource governance is shaped by cross-scale linkages. The results of our research therefore will be widely disseminated to political scientist and policy scholars through scholarly meetings and journal articles

From a practical standpoint, the information gathered in this study also will be of value to water management professionals, such as state water rights administrators, and state and federal policymakers. The literature on interstate water compacts has been growing in recent years, but with little attention to comparing the policy features of compacts. The value of improved knowledge in how states address the division of limited supplies cannot be overstated. The western United States is currently facing a sixth consecutive year of drought conditions and compacts were created primarily between the mid 1930s and 1960s, generally relying on inadequate streamflow data for apportionment (Grant 2003). Within the next few years, western states are going to be faced with tough decisions about how to deal with outdated compacts and flow allocations that simply cannot be met. Thus, water managers and political officials certainly can benefit from an informed analysis of the policy features of interstate compacts. We will make this information readily available to compact administrators and water managers by disseminating the findings to professional meetings.

Finally, this research will contribute to each of the authors' teachings and continued scholarship in environmental policy. Each of the principle investigators has a well-established research program in institutional analysis and water resource management, which they incorporate into their respective courses in environmental policy and management. This research will hopefully provide fresh angles from which a future generation of policy scholars and analysts will look at institutions.

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