

**Transboundary River Governance in the Western US:
The Role of Cross-Scale Linkages in Interstate Compact Compliance***

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Recently, in common pool resource studies, considerable effort and attention has been devoted to relations, ties, and linkages among different governments, organizations, resource user associations and groups at different scales. These relationships and linkages are posited to affect the ability and capacity of 1) resource users to engage in collective action and devise governing arrangements for common pool resources (Ostrom 1990), 2) resources users to collaborate and coordinate across multiple resources and/or jurisdictions to address regional problems (Blomquist, Schlager et al. 2004), 3) national governments to devolve authority and resources to lower levels of government to govern common pool resources (Berkes 2002), and 4) national governments to effectively enforce and administer treaties, agreements, and other arrangements to address international and global common pool resource problems (Young 2002a; Webster 2009)

These linkage and ties, often referred to as “cross-scale linkages”, in general occur between arrangements at the same level of organization or authority (e.g. horizontally between states) or between different levels of organizations (e.g. vertically between an international regimes and national government) (Young 2002a). According to Berkes (2002), these general types of linkages, however, take myriad forms in the governance of common pool resources, such as co-management between central governments and local-level resource users who share authority over resource decisions, multi-stakeholder bodies from different jurisdictions that engage in advice and policymaking, or social movement networks. Moreover, in any natural resource setting or social-ecological system, multiple types of cross-scale linkages can exist concurrently, making up a polycentric system of governance. In such polycentric settings, Andersson and Ostrom (2008) note that focusing on one type of cross-scale linkage, such as co-management or decentralized governance, can give an inaccurate picture of governance capacity

and benefits of such linkages without considering the other types of linkages in these systems (Andersson and Ostrom 2008). Identifying, measuring, and assessing the complex array of cross-scale linkages in any given common-pool resource setting or social-ecological system, however, is no simple task. Not surprisingly, a number of scholars have begun to push for more careful operationalization and rigorous assessments of these range of cross-scale linkages and how they interact (Carlsson and Berkes 2005; Andersson and Ostrom 2008).

Watersheds, river basins, and water allocation systems (i.e. irrigation systems) are one category of common pool resource where cross-scale linkages and ties can be vast and diverse given the complexity of watersheds, multiple types of interacting and overlapping resources and resource users. The linkages and ties of resource users, associations, and governments at different scales, not surprisingly, have been viewed as particularly influential in shaping the performance of different forms of watershed management. International organizations, such as the World Bank, the United Nations Development Programme, and the Global Water Partnership, are actively promoting integrated river basin management and are encouraging recipient countries to substantially revise their water laws to encourage both integration across diverse water sectors, as well as increased linkages between national governments and local citizens (Global Water Partnership 2007; Kemper, Blomquist et al. 2007; United Nations Development Programme 2009) . The European Union (EU) likewise, under the EU Water Framework Directive, has been promoting greater basin-level coordination between EU member states, as well as among differing sectoral water users.

In the US debates, discussions, and experiments with watershed and river basin management have a long and lively history extending over a century (Sabatier, Weible et al. 2005; Schlager and Blomquist 2008). The federal government has engaged in numerous efforts

and experiments with river basin management, ranging from the Tennessee Valley Authority to the implementation of the total maximum daily load (TMDL) requirements under the Clean Water Act, with limited effect and success, largely because control over and governance and administration of water rests with states. The most successful federal government efforts have been those that have been embraced by states or that assist states in addressing pressing water problems without undermining states' authority and control (historically, large surface water projects, more recently, funding to support watershed partnerships to address water quality and riparian and aquatic habitat and endangered species).

Given the state-centric focus on water governance and administration in the US, it is somewhat surprising that little attention has been paid to how states govern interstate watersheds and river basins. For the past 80 years states have engaged in allocating and managing water supplies of multi-state river basins through interstate compacts. Compacts, which are provided for under the U.S. constitution, allow states to develop, adopt, and engage in treaties with one another that in many cases create limited regimes or governments for the purposes of administering water allocation agreements. States are the authors and members of these compacts. They make commitments to one another about water allocation and use of native surface flows, project water, and groundwater. However, states are not water users; rather local jurisdictions, such as municipalities and irrigation districts, and private citizens are water users. Consequently, the ability of states to abide by their compact commitments rests heavily on their ability to gain the cooperation and compliance of water users to restrain their water use to within compact defined water allocations, even if their state allocated water rights collectively allow them to exceed compact allocations.

Interstate river compacts highlight and exemplify the importance of cross-scale linkages within a watershed. The design, structure, and organization of compacts define linkages and relations among and across states, or what Young (2002a) refers to as horizontal linkages. In addition, the relations and linkages between state governments and water users, or vertical linkages, affect the operation of compact governing bodies and compliance with water allocation rules. In this paper we focus on the relations between state governments and water users and the effects of those relations and ties on the operation and performance of compacts, in particular the ability of states to comply with their compact commitments. To help identify what types of cross-scale linkages would affect the operations and compliance with compacts, we conduct a brief review of the burgeoning literature on cross-scale linkages and compliance. This review provides guidance for developing measures of linkages as well as suggesting research questions. Next, we provide a short overview of interstate river compacts, what they are, and how and why they were created. The types of compliance issues that may arise in the context of interstate compacts and their cross-scale linkages are also explored. We then engage in a preliminary analysis of these linkages to begin to explore the research questions and conclude with a discussion of the implications of these linkages, as well as how these data can be assessed in more depth in future analyses.

Literature Review (under construction)

Do Certain Types of Cross-Scale Linkages Support Effective CPR Governance?

Young (2002a; 2002b) and others have defined cross-scale linkages broadly as either horizontal or vertical. Young also notes that neither horizontal nor vertical linkages, in and of themselves, are panaceas for robust resource governance. That is, some “links may generate consequences that are benign, as in cases where regional regimes gain strength from being nested

into global regimes, or malign, as in cases where national and use regulations contradict or undermine informal systems of land tenure operating at the local level” (Young 2002a p.264).

Just as important as the existence of cross-scale linkages is their structure. Recent research on co-management and decentralization, for instance, provides some insights into the complex and diverse ways that cross-scale linkages might be structured. Superficially, co-management, commonly involves sharing power between national governments and resource users, as well as local governments, civil society and private sectors (Carlsson and Berkes 2005). Similar descriptions of decentralization of government authority to manage local resources have been offered in the literature, but often taking the linkage between larger scale governments and local users a step further –whereby local, non-governmental, and private actors are granted authority and resources by larger-level governments to make self-governing decisions over resource management (Ribot, Agrawal et al. 2006).

Both literatures recognize that the operational nature of the linkages in a co-management or decentralized setting may be much more diverse than these general definitions suggest. Scratching the surface of these linkages a bit more, we see that a variety of types of arrangements and linkages fall under the rubrics of co-management and decentralization, ranging from informal advice and information sharing, to consultation between scales of authority, to more formal partnerships and agreements (Berkes 2002; Carlsson and Berkes 2005; Njaya 2007). In addition, scholars have pointed out that operational definitions of co-management, centering only on what actors do or produce, do not capture the complexities underlying these institutional arrangements (Carlsson and Berkes 2005; Andersson and Ostrom 2008). These complexities are tied to 1) polycentricity – or overlapping system of governance – within which any particular co-management regime or cross-scale linkage is embedded; and 2) the collective choice processes

(e.g. system of rules, participation and authorities) that any co-management or decentralization process creates in and of itself (Carlsson and Berkes 2005; Kemper, Blomquist et al. 2007; Andersson and Ostrom 2008). Understanding that such cross-scale linkages are arenas for joint problem solving, versus shared decision-making, and thus systems of “governance”, embedded within larger systems of governance, can help direct scholars to many of the key features of these systems that support robust or effective governance – features that may be missed if simply looking at a single type or operational form of linkage. Furthermore, as Andersson and Ostrom (2008) note: “The patterns of interaction and outcomes depend on the relationships among governance actors at different levels and the problems they are addressing” (p.73).

When taking into consideration the conditioning of both the larger, polycentric institutional setting, and the collective choice structure of a particular co-management process, one common theme is the importance of genuine authority for local resource users to contribute to the problem-solving and management of common-pool resources, regardless of the “type” of cross-scale linkage established. In other words, it is necessary to assess the ability of actors “to craft and adjust their own rules over time, thus increasing the likelihood of these rules being effective in regulating resource use” (Andersson and Ostrom 2008 p.78). Additionally, the authority of actors to participate actively in constitutional and collective choice decisions within the resource governance arena and the establishment of regular and sustained information sharing and communication between different scales of decision-making are further seen as critical features of cross-scale institutional linkages (Kemper, Blomquist et al. 2007). While much of the literature suggests that the benefits of such conditions are the greater likelihood of improved resource management, Carlsson and Berkes (2005) recognize a wide range of benefits of these features, which include opportunities to better allocate tasks (e.g. benefitting from

specialization of labor and activities), share resources, improve information flow, reduce transaction costs, share risks and resolve conflicts.

The Interplay between Types of Linkages: Implications for Institutional Compliance

When branching out beyond single idealized types of cross-scale linkages, the question of the benefits of certain types of linkages becomes even more challenging. Take for example the role of vertical cross-scale linkages in supporting compliance with agreements, specifically those created through horizontal linkages (like regional, interstate and international agreements). International relations scholars, including Young (2002a), have been particularly interested in this issue. Would, for instance, decentralized linkages between states and citizens, foster compliance with larger-level governance agreements, established through horizontal cross-scale linkages? Or, would states with highly decentralized cross-scale linkages be challenged to comply with international agreements? Young's work on institutional interplay between international and national environmental regimes points out that the answer depends critically on the context, such as the issues at stake and the problems to be resolved, plus three key factors (Young 2002a; Young 2002b). These three factors include the competence of the member governments involved in international regimes to enter into commitments, the compatibility of laws and fit of the rules between the international agreements and national institutions, as well as the capacity, including resources, authority, and social capital, "needed to make good on commitments entered into at the international level" (p. 278). Young's concepts may be used to tease out where certain types of cross-scale linkages that theoretically should support compliance and effective governance (e.g. capacity through co-management) may not produce expected results when they are confounded by linkages across scales that are incompatible.

In the watershed management field, institutions created at basin levels, whether international, inter-state, or intra-state, raise questions about how best to ensure that the participants comply with the rules and commitments embedded in the agreements. Common pool resource theory and work on decentralization provide insights. Both of these literatures tend to focus on the autonomy and capacity of local resource users and local governments to engage in self governance and the role of higher level governments in supporting or undermining self-governance. For instance, Ribot et al (2006) point to administrative and financial authority and administrative capacity and locally oriented accountability mechanisms as critical dimensions. In common pool resource theory compliance with locally designed rules is supported when higher level governments provide low cost information about the common pool resource, or shoulder some of the costs of monitoring, or provide low cost conflict resolution arenas (Ostrom 1990; Ostrom 2005).

What has not received as much attention is more varied complex co-management settings, and the conflicts and clashes of interests and values that characterize many linkages. For instance, a decentralization hypothesis developed, tested, and not rejected by Andersson and Ostrom (2008) raises new issues when examined in a different co-management setting. The hypothesis states, “the effect of upward political pressure on local politicians to invest in natural resource governance activities will be stronger in more decentralized regimes”. If one was examining not local level resource governance, but a regional government attempting to address natural resource problems that spillover several local governments, the implications may be different. Will well organized local resource users resist attempts on the part of a regional government to address region wide problems? Are decentralized states much less likely to

comply with compacts than highly centralized states because locals have little interest in achieving state government values and goals?

These questions raise another understudied area of co-management studies and compliance with agreements, conflicts over whose interests and values matter among the interacting and overlapping organizations and governments, and the strategic interactions among them. The international relations literature on compliance has begun to recognize these complexities (Mitchell and Hensel 2007). As Mitchell and Hensel (2007:722) state, “the ultimate litmus test of cooperation and compliance theories occurs in situations where states’ interests are directly opposed”. Values and interests may conflict for a variety of reasons, distributional issues may dominate the conflict, or parties may want to realize equally legitimate, but conflicting values. Mitchell and Hensel (2007) examine how differently structured institutional linkages work to discourage opportunistic behavior and support problem solving actions.

That is our point of departure as well. How do cross scale linkages affect and structure conflicts and condition how they are resolved? Using Young’s language, incompatibilities between interstate agreements and the laws and rules of member states are flash points that challenge compliance. Attempting to align laws and rules with agreements may address compatibility issues, but raises questions about the capacities of member states to do so. Do states exercise sufficient authority to change rules to address compatibility conflicts? Do states control the necessary resources to comply with interstate agreements? How is the capacity of a state conditioned by its constitution and the ability of citizens to self-organize? Will well-organized, self-governing groups of citizens be able to undermine the efforts of regional or state governments to pursue a broader mix of values? Will strong, centralized state governments have greater capacity to comply with interstate agreements than do more polycentric state

governments characterized by checks and balances and overlapping authorities? These are some of the questions we seek to address. Our focus is on how linkages affect and condition conflicts among governments at different scales, in particular conflicts that challenge governments to comply with intergovernmental agreements.

Empirical Setting

In a federal system, addressing problems whose scope overlaps with multiple semi-autonomous governments involves the participation of those governments and the citizens they represent. As Elazar (1987:5) notes, “federal principles are concerned with the combination of self-rule and shared rule. In the broadest sense, federalism involves the linking of individuals, groups, and polities in lasting but limited union in such a way as to provide for the energetic pursuit of common ends while maintaining the respective integrities of all parties”. Thus, addressing regional water problems in the context of federalism requires finding a workable balance between maintaining the integrity and self-rule of individual states while at the same time linking the states in ways that allow for shared rule in the pursuit of common ends.¹

Most compacts not only allocate water among states but also create governments to administer, monitor, and enforce the water allocation agreement, and in that sense compacts are also constitutions. The constitutions define a collective choice body, the number of state representatives to the body, its powers and authorities, and its decision rules. Compact governments, however, are unlike most governments in the U.S. in that they govern states and not citizens. Compact governments devise rules and regulations that state governments are to abide by and that guide state governments in administering water rights within their jurisdiction.

¹ The compact clause of the U.S. Constitution allows states to engage in “treaties” with each other, with a single caveat – Congressional approval that provides a check on the process ensuring the compact does not violate the national interest. A state based treaty making process emphasizes the self-rule and integrity of the states and is by far the most common mechanism used to allocate water.

Compact governments do not devise rules and regulations that directly and immediately govern the citizens of member states. Thus, compacts are as “energetic” as their member states choose to make them.

Overview of Interstate River Compacts

In this, our initial effort to examine and measure cross-scale linkages and the effects of linkages on compact compliance, we examine a subset of interstate river compacts in the western United States, which we have studied under a larger research project on western water governance and conflict.² These operate as self-governing state-to-state agreements for water allocation. For this paper we focus on eight of the 14 compacts in our larger study. These eight involve five different member states, governing rivers in the high plains and southwest region of the U.S. They include the Arkansas, Big Blue, Costilla Creek, La Plata, Pecos, Republican, Rio Grande, and South Platte, and their member states include Colorado, Kansas, Nebraska, New Mexico and Texas (see Table 1 below). The basins selected for this analysis tend to be located in relatively dry climates. The Big Blue, which is the most eastern of the eight, and consequently the wettest. Groundwater is a vital source of water in all but two of them, the Costilla Creek and the La Plata, which are also the smallest, in terms of water volume. Even though groundwater is vital in six of the eight, only one, the Big Blue, explicitly recognized and included groundwater in its allocation rule; only after significant conflict has groundwater been explicitly incorporated into two more – the Arkansas and the Republican. In general, states struggle to manage and regulate groundwater use and this has been reflected in the operation of the compacts. All but

² This study, funded by the National Science Foundation, involved collecting original data from the compact annual reports, meeting minutes, and secondary sources, which have been coded using a set of coding forms based on the Institutional Analysis and Development Framework. The coding forms include information on the constitutional, collective choice, and operational levels of decision-making for each of these compacts, as well as data on conflicts and problem solving that compact commissions have addressed and resolved over time. Additionally, this project has coded data on the member states to these compacts, including their water administration structures and state water laws.

two have compact commissions, and the commissions have regularly met for three or more decades. Even the two without commissions, the South Platte and the La Plata, are actively administered by the upstream state. Finally, five have been before the Supreme Court, one multiple times, as states struggled over compliance issues. Given our focus on compliance it is reasonable to begin by examining those compacts in which compliance issues have been repeatedly raised and addressed. We plan to include other compacts in which compliance issues have not been raised, or are just beginning to be raised, in the next version of this paper.

Table 1. Interstate River Compacts

Compact	Members ^a	Annual Precip	Ground water ^b	Commission	Supreme Court
Arkansas	Colorado (u) Kansas (d)	20 in	Yes (i,r)	Yes	1907, 1943, 1986
Big Blue	Nebraska (u) Kansas (d)	25 in - 34 in	Yes (i,r)	Yes	No
Costilla Creek	Colorado (u,d) New Mexico (u,d)	16 in	No	Yes	No
La Plata	Colorado (u) New Mexico (d)	13 in	No	Not active	1935
Pecos	New Mexico (u) Texas (d)	10 in-17 in	Yes (i)	Yes	1983
Republican	Colorado (u) Nebraska (u,d) Kansas (d)	20 in	Yes (i,r)	Yes	1998
Rio Grande	Colorado (u) New Mexico (u,d) Texas (d)	3 in – 16 in	Yes (i)	Yes	1937 1966
South Platte	Colorado (u) Nebraska (d)	7 in – 30 in	Yes (i)	No	No
^a u = upstream state; d=downstream state ^b i = groundwater is an issue among the parties to the compact; r = compact regulates groundwater					

The origins of each compact also provide context for the compliance issues the states face, it is useful to consider the original intentions of states in entering into these agreements. As illustrated in detail in Appendix 1, western interstate river compacts emerged from a combination

of factors that resulted from the stresses of competing demands or the needs for water storage to manage highly variable water supplies (subject to drought and flooding). Three of the 8 compacts, the Costilla Creek, the La Plata, and the South Platte, were created as a means to avoid or to settle lawsuits by water users in downstream states claiming that water users in upstream states were impairing their rights. The other six compacts, however, emerge from the combination of factors including conflicts, the spark of a focusing event like a flood, and the promise of a federal water project. For instance, the Arkansas River Compact emerges after severe flooding prompts the Army Corps of Engineers to propose a water conservation and flood control reservoir. Prior to the intervention of the Corps, Colorado and Kansas had been before the Supreme Court twice seeking to resolve the conflicts among their water users with little success. Once the water project was being built, the states came under intense pressure to resolve their water conflicts and to agree on a plan for operating the reservoir by adopting a compact.

As the member states involved in these compacts came to realize the need for an interstate agreement, they typically spent years negotiating a set of allocation rules among representative officials from state water agencies, and often irrigation interests. The allocation rules that emerged under the compacts are shown in Appendix 2. One type of allocation rule is a fixed rule, which three compacts use for some or all of their native streamflows. Either an upstream state guarantees specific minimum streamflows to a downstream state, as in the case of the South Platte and the Big Blue, or each state is allocated a fixed amount of water, as is the case with the Republican.³

³ The Arkansas River Compact contains an unusual fixed allocation rule that behaves like a minimum flow rule but over years, not months. The compact allows for the development of water, i.e. large surface water storage facilities, but forbids the material depletion of native flows. Thus, Colorado is required to ensure that any new water projects, projects junior to the compact, do not materially deplete the river. In other words, Colorado is committed to a particular flow regime, that which existed as of the adoption of the compact. New water development would entail flood control, in which the flood waters would be temporarily captured, thus averting flooding, but upon release would be governed by the compact; or water development would entail the importation of water from another basin,

Four compacts use proportionate allocation rules, either exclusively (Costilla Creek, La Plata, and Rio Grande) or to allocate a major source of water (Arkansas). Proportionate allocation rules distribute a portion of the water available to each state. Proportionate rules may be fixed, like the La Plata⁴, in which the proportion of water to each state is fixed, no matter the volume. Alternatively, proportionate rules may be variable, such as the Costilla Creek and Rio Grande⁵, in which the proportion of water to each state varies depending on volume.

A number of compacts have adopted additional rules to further specify who will bear the brunt of water shortages to ensure that compact allocations will be met. Four compacts (Arkansas, Big Blue, Republican and South Platte) specify the appropriators in the upstream states who will have their water appropriations shut down to satisfy compact requirements.⁶ For instance, the South Platte River Compact specifies that Colorado appropriators located between the western boundary of Washington County and the state line, with water rights subsequent to June 14, 1897, will not be allowed to divert water if it interferes with Colorado's delivery of 120 cubic feet per second (cfs) daily to the state line during the irrigation season. Colorado appropriators in the upper section of the river, e.g. the Denver metropolitan area, are exempt from compact administration of their water rights. The remaining three compacts exempt water

and the imported water would not be part of the compact. Any water developed after the compact that materially depletes the flows of the river, such as groundwater pumping, would have to mitigate its effects on river flows.

4 For instance, the La Plata Compact uses a fixed proportion. During the irrigation season, if state line flows fall below 100 cubic feet per second (cfs), the La Plata Compact requires Colorado to deliver 50% of the water flowing past the Hesperus gage (located 30 miles from the state line) to New Mexico. The fixed proportion rules for the La Plata only kick in if the flow at the state line gage dips below a certain level, otherwise the states have free use of the water in the river.

5 In the Rio Grande, if the flow of the Conejos River (a major tributary of the Rio Grande) and a number of its tributaries is less than 100,000 acre feet, then Colorado is not required to deliver any Conejos water to New Mexico, however, if the flow of the Conejos River is 150,000 acre feet, then Colorado must deliver 20,000 acre feet or approximately 13% of the flow. If the flow of the Conejos is 700,000 acre feet then Colorado must deliver 476,000 acre feet, or 63% of the flow.

6 If a compact does not specify appropriators subject to compact administration of their water rights then it is assumed that all appropriators in the compact basin in the upstream state are subject to the compact. See *Hinderlider v. La Plata River and Cherry Creek Ditch Company* (1938) in which the US Supreme Court held that compact law supersedes state law.

rights with priority dates prior to compact adoption, placing the burden of water shortages on water rights developed after the compact came into existence.

Compact allocation rules are relatively complex. Most compacts use multiple rules that vary by season, by type of water, by type of allocation (fixed, proportionate, or priority), by location on the river, and by appropriators subject to compact administration. Added to the diversity in allocation rule types is the fact that many of the allocation rules also depend upon complicated conditions, contingencies or formulas. Such complexity arguably increases the challenges they present for obtaining and maintaining compliance.

The Problem of Compliance: Compacts and Compatibility with State Laws

As described above, compliance means that states abide by and follow the terms of the agreements that they enter into. In particular, for this paper, we focus on how vertical linkages within member states shape the capacity to comply with horizontal linkages established through compacts' water allocation rules, which are the heart of interstate river compacts. Compliance with water allocation rules is fraught with conflicts and contradictions. Within all states, state water laws, which govern individual water users, create compatibility problems with interstate compact laws that are direct and sharp. Such compatibility problems centers on compact law versus state law. While compact law has precedence over state law, state law does not limit the allocation of water to within compact limits. All state laws allocate water rights to their citizens that far exceed compact allocations. This is largely due to the prior appropriation doctrine that western states use to allocate surface water and sometimes tributary groundwater. The prior appropriation doctrine lines up water claimants temporally – first in time, first in right, last in time, last in right. Those with senior rights typically are allocated water, those with junior rights may only receive water during limited times of the year, and those with very junior rights may

only realize water during wet years. It does not matter if water is available to satisfy all water rights. Consequently, most western river basins are over allocated. More water rights have been recognized than there is water to satisfy them.

For all interstate river compacts this means that water users may legally exercise their state granted water rights and divert water off the stream, and in so doing directly violate the water allocation rule of a compact. Water users demand that the state allow them to exercise their legally recognized water rights. The state in turn is placed in the position of having to shutdown legal water diversions in order to comply with compact water allocation rules. Thus, the conflict between water users and state governments may be quite sharp. While states are required to comply with compact water allocation rules, and states can enforce these requirements against each other, the motivations for states to do so are mixed. On the one hand, they will be held accountable for compliance. On the other hand, compliance means shutting down the lawful diversions of their water users in order to benefit the water users of another state – a problem of compatibility. Upstream states may be less than exuberant in responding to compliance claims, they may even try their best to put off or avoid such claims, but once an authoritative decision is made, they must take action to limit the water use of their citizens. Thus, compliance with interstate river compacts is a non-trivial matter. If all compacts are challenged by this issue of compatibility, the question then is whether and how the capacities of states, through their vertical linkages with water users, further shape compliance.

Data and Methods for Assessing Cross-Scale Linkages and Compliance

The data on cross-scale linkages and compliance were collected as part of our broader study on interstate compacts. The specific indicators for cross-scale linkages are described in detail in the following section. The key types of vertical linkages we address in this paper are

tied to the capacity features Young (2002a) describes – capacity that is for member states to bring citizens into compliance. (Measures of competence, through horizontal linkages of the compact commissions, we address in a forthcoming paper). These capacity measures include a measure of constitutional linkages between states and local governments, using a dataset on “home-rule” developed by Zimmerman (1981) and indicators of cross-scale linkages identified through our coding of water administration agencies in compact member states. After describing these linkages, we then consider how they relate to the compliance problems and their outcomes, which we identified over time with the eight compacts. The compliance outcomes were identified using primary documents from the compact commissions and coded according to the source of the compliance problem, the issues address, the duration, parties, and resolution forums. In discussing these outcomes, we also briefly touch upon the issue of compatibility between state and compact laws, which factor into compliance across all states.

Capacity Linkages among States and Water Users

A key to understanding the capacity of states to meet their compact commitments is to consider the relations between local water users and state governments. For this paper we focus on two measures of vertical linkages – one is a measure of the constitutional setting of each state and how that setting allocates power and authority to local level governments. As Carlsson and Berkes (2005) note, co-management centers on the constitutional and collective choice levels of actions -- how rule making and governing authority is allocated across different governments and among citizens. In the U.S. one commonly used concept to capture the constitutional allocation of authority between state government and local governments is home rule. Home rule refers to the extent that local governments can exercise discretionary authority over their own affairs without interference from the state government (Zimmerman 1981). More specifically,

Zimmerman (1981:1) defines it as “the power of a local government to conduct its own affairs – including specifically the power to determine its own organization, the functions it performs, its taxing and borrowing authority, and the numbers and employment conditions of its personnel”.

Zimmerman (1981) devised a scale measuring the extent of home rule by state. The scale ranges from 1-5, with 1 indicating a high level of home rule, or significant local level discretion, and 5 a low level of home rule, or very limited local level discretion. The scale is a composite of measures that focus on the constitutional authority of municipalities and counties to govern and control the functions they may engage in, the level of control over their finances, and the level of control over their personnel. Thus, it is a limited measure of home rule authority. By only focusing on the powers of municipalities and counties it fails to also account for the ability of citizens to exercise a variety of self-governing powers, such as recalling officials or placing items on ballots to be voted on, nor does it capture the ability of citizens to form their own local governments, and change the boundaries of those governments. Nevertheless, it is the only well-known index of home rule presently available.

Table 2 presents the home rule scores of the five states who are members of the eight compacts covered in this paper. Since compliance for purposes of this paper centers on compliance with the water allocation rules, the focus is on the actions of the upstream states. Are they allowing water to pass to the downstream states in accordance with compacts’ rules? There is variation in the home rule scores of the three states that are upstream, or both upstream and downstream, in one or more compact. Colorado, which is upstream in five compacts and both upstream and downstream in another compact, has a home rule score that is notably lower than the other two upstream states. Both Nebraska and New Mexico have scores above 3, whereas

Colorado’s score is 2.75. Colorado’s constitutional setting allows for greater local discretionary authority than does the constitutional setting of Nebraska or New Mexico.

Table 2: Home Rule Scores for States Party to Eight Interstate Compacts

State	Compact Membership (and Position in Basin)	Home Rule Score*
Colorado	Arkansas (upstream) Costilla Creek (downstream & upstream) La Plata (upstream) Republican (upstream) Rio Grande (upstream) South Platte (upstream)	2.75
Kansas**	<i>Arkansas (downstream)</i> <i>Big Blue (downstream)</i> <i>Republican (downstream)</i>	2
Nebraska	Big Blue (upstream) Republican (downstream & upstream) South Platte (downstream)	3.1
New Mexico	Costilla Creek (upstream & downstream) La Plata (downstream) Pecos (upstream) Rio Grande (downstream & upstream)	3.5
Texas**	<i>Pecos (downstream)</i> <i>Rio Grande (downstream)</i>	2.87
*Home rule score from Zimmerman (1981). Lower scores denote greater home-rule ** Kansas and Texas are both only downstream and thus excluded from the remaining analyses of cross-scale linkages in this paper		

As discussed in the literature review, the level of discretionary authority may affect the ability of a state to meet its compact requirements. Greater local level authority may provide water users the power to resist state government attempts to bring them in line with state government goals. In a home rule state like Colorado, local values and preferences may predominate over state level values. Thus, Colorado may have a more difficult time meeting its compact commitments than the other two upstream states.

The constitutional setting is not the only important level in characterizing vertical linkages, the collective choice setting is vital as well (Carlsson and Berkes 2005). The collective choice setting centers on the actors who have authority to develop and implement operational

level rules and who have the authority to monitor and enforce those rules, and is, obviously, established under the constitutional level of governance (Ostrom 2005). Thus we would expect some degree of similarity between the indicators of cross-scale linkages at the constitutional and collective choice levels.

We measure the collective choice setting of each state by identifying the state agencies who develop, administer, monitor or enforce the states water laws and who arrange for and finance water infrastructure projects. Table 3 lists each agency, its powers, and its ties to interstate river compacts and other state water agencies.⁷ Here again there is notable variation among the upstream states. New Mexico appears highly centralized with most powers residing in the Office of the State Engineer. Colorado appears polycentric with powers allocated across multiple agencies and branches of government. Nebraska appears fragmented, a state level agency exercises authority over surface water, developing, administering, and enforcing rules, however, groundwater is governed by local resource districts controlled by local water users. There is very little overlap in powers between the state agency and the local resource districts.

New Mexico has a tradition of a strong and powerful State Engineer's Office. The New Mexico state engineer has the authority to develop and administer water allocation rules for both ground and surface water, issue well permits, issue surface water rights, develop a statewide water plan, engage in drought planning, and monitor and enforce rules. For New Mexico it is the state water agency that develops rules and regulations for all forms of water, and that administers laws and rules, monitoring and enforcing them. Furthermore, the State Engineer is the New Mexico representative on each of its compacts. The New Mexico State Water Engineer appears to exercise adequate authority to regulate water users in accordance with New Mexico's compact commitments.

⁷ Table 5 encompasses all five states, however, our discussion will only focus on the upstream states.

Table 3: Water Agencies of States Party to Interstate Compacts

State Agency	Date of Origin	Geographic Scope	Jurisdictional Scope	Adm rule making	Compact Commissioner	Agency Overlap
<i>Colorado</i>						
Water Courts (WC)	1876	River basin	Develop sw, gw laws; monitor enforce	No	No	OSE, GC
Groundwater Commission (GC)	1965	State w/ basin offices	Develop nontrib gw laws; issue well permits; designate gw basins; monitor enforce	Yes	No	WC
Office of State Engineer (OSE)	1881	State w/ basin offices	Admin sw, gw laws & gw wells; issue well permits; monitor enforce; adm water markets; dam safety; develop water databases	Yes	Yes	WC, GC
Water Conservation Board (WCB)		State	Gw management plans; develop/finance water projects; drought planning; flood control; administer water funds	No	No	
<i>Kansas</i>						
Office of the State Engineer (OSE)	1927	State w/ branch offices	Admin sw, gw laws; monitor enforce; flood control; dam safety	Yes	Yes	GW
Groundwater Management Dist (GW)	1976	Gw basin	Admin gw laws, wells; well permits; monitor water quality	Yes	No	OSE
Water Office	1981	State w/ basin offices	State water plan; adm water markets; adm water funds; drought planning	Yes	No	
<i>Nebraska</i>						
Dept. of Natural Resources		State w/ basin offices	State water plan; adm sw law; issue sw permits; issue well permits; monitor enforce; water databases; flood control; dam safety; adm water funds	Yes	Yes	
Natural Resource Districts	1972	Sub-basin	Gw management plans; gw quality plans; adm gw laws; adm gw wells; designate management areas; issue well permits; monitor enforce; monitor water quality; flood control; develop finance projects	Yes	No	
<i>New Mexico</i>						
Office of the State Engineer	1907	State w/ regions	State water plan; adm sw, gw laws; adm gw wells; issue sw rights; issue sw, gw permits; issue well	Yes	Yes	ISC

			permits; monitor enforce; drought planning; dam safety; develop finance water projects			
Interstate Stream Commission	1935	state	Water planning; monitors & manages water deliveries under compacts	No	No	OSE
<i>Texas</i>						
Water Development Board	1957	State w/ branches	State water plan; monitor water quality; adm water funds; develop finance water projects; water databases	No	No	
Commission On Environmental Quality		State w/ branches	Adm gw laws; designate water management areas; issue sw permits; monitor water quality; develop finance water projects; water databases; drought planning; dam safety	Yes	No	

In contrast to New Mexico, Colorado has divided its water authority among multiple agencies. While Colorado, too, has a State Engineer that may engage in rule making and monitoring and enforcement, just like the New Mexico State Engineer, it is not the only office or agency that exercises those powers. Colorado, unlike any other state, also has a long and well established tradition of water courts. Each of the seven major river basins in Colorado has its own water court. Water courts are where water users develop surface and groundwater rights and modify and transfer those rights. Water court must approve each rule and regulation the State Engineer promulgates to ensure it does not violate Colorado law, and water courts hear and attempt to settle all types of water conflicts. In addition, the Colorado Water Conservation Board engages in water planning, developing and financing water infrastructure projects, and water research and information development. The Board provides assistance to the State Engineer who is the representative for Colorado on compact commissions. Thus, it tends to be more of a support agency than a regulatory agency. Finally, the Colorado Groundwater Commission regulates nontributary groundwater, designating groundwater basins, issuing rules and

regulations and well permits, and monitoring and enforcing rules and regulations. Overall, there is considerable overlap among Colorado's water administrative bodies. The State Engineer and the water courts tend to surface water and tributary groundwater; the Groundwater Commission and the water courts oversee nontributary groundwater, with the State Engineer providing monitoring and information collection. The Water Conservation Board engages in state wide planning and water infrastructure development, both activities in close consultation with the State Engineer's office.

Nebraska, unlike the other two states has organized its water administrative agencies around specific forms of water with no overlap in authority. The Department of Natural Resources has the authority to regulate and administer surface water, issue surface water permits, issue well permits for information purposes only, oversee flood control and dam safety, develop statewide water plans, and monitor and enforce rules and regulations regarding surface water. The Director of the Department is also the Nebraska representative on compact commissions. However, the Department has very little authority in relation to groundwater. The authority to administer and manage groundwater is granted to local level natural resources districts. The districts have rule making and enforcement authority. The districts are governed by locally elected boards and thus are dominated by local water users. There is very little overlap between the Department of Natural Resources and the natural resources districts. Each has its separate powers over separate, but hydrologically connected, sources of water.

In considering both cross-scale linkage measures together, there is reason to expect variation among the upstream states in gaining the compliance of local water users. Both of the cross scale linkage measures point in one direction for New Mexico. The home rule measure suggests that New Mexico water users have less local discretionary authority than water users of

the other states. Furthermore, this is coupled with a strong, centralized Office of the State Water Engineer which has wide ranging authorities to regulate and enforce surface water and groundwater use. The cross scale linkage measures suggest that New Mexico may have the most direct control over water users and may more readily bring them into compliance with its compact commitments.

The cross scale linkages measures for Colorado appear to balance each other. On the one hand, local water users have more discretionary authority than water users of the other two states; however, this is combined with multiple, overlapping state agencies and courts that exercise joint authority over all types of water. Colorado is more of a polycentric system, providing water users with many opportunities to participate and influence water decisions, while also providing the state government with multiple mechanisms for influencing water users' behavior. Colorado is likely to bring its water users in line with its compact commitments, although the process is likely to differ from that of New Mexico.

The cross scale linkages measures for Nebraska suggest a more problematic setting. On the one hand, local jurisdictions exercise less discretionary authority, but that limited authority is not matched with a strong central state water agency. Rather, state level water administration appears fragmented. There is very little overlap between surface water administration and groundwater administration and groundwater administration is centered at the local level. Consequently, Nebraska may have some success in bringing surface water users in line with compact commitments, but may struggle to bring groundwater users in line.

Cross-scale Linkages and Compact Compliance

Table 4 summarizes the compliance claims and activities surrounding each of the eight compacts covered in this paper. Of the eight compacts, two have not experienced compliance

claims (the Big Blue and the South Platte) and one has handled compliance issues within the context of the compact commission (Costilla Creek). The remaining five compacts have had their compliance claims ultimately addressed by the U.S. Supreme Court.

Table 4. Compact Compliance Issues and Resolution

Compact	Issues	Complainant	Resolution Venue	Action Taken	Action Scope	Response Time
Arkansas	CO materially depleting flows	Kansas (downstream)	Commission – failed; US S Ct	Hydrologic Model; CO develop gw rules	GW; Arkansas Basin	2 years
Big Blue	None	--	--	--	--	--
Costilla Creek	1. NM water users take water 2. CO reservoir company diverts excess	1. commission 2. NM citizens downstream of reservoir diversion	1.commission 2.commission	1. hire water master; adm NM laws; 2. adm compact rules	SW; Costilla Creek	1. 1 year 2. 2 year
La Plata	Compact rules, CO water law conflict	CO water users (upstream)	CO Water Court; CO S Ct; US S Ct	Compact supersedes state law	All compacts	2 years
Pecos	NM violates “1947 condition”	Texas (downstream)	Commission – failed; US S Ct	Hydrologic model; river master; NM purchase water; NM adjudicate sw rights; NM develop basin plan	Pecos River Basin, NM	20 years and ongoing
Republican	CO, NE taking water over allocation	Kansas (downstream)	Commission – failed; US S Ct	Hydrologic model; NE passes 3 major laws	statewide	7 years and ongoing
Rio Grande	1. NM taking over allocation 2. CO taking over allocation	1. Texas (downstream) 2. Texas, NM (downstream)	1. US S Ct 2. US S Ct	1.NM and BOR develop water project 2. CO adm sw laws; adopts gw regs	Rio Grande Basin	1. 10 years 2. 17 years
South Platte	none	--	--	--	--	--

The Costilla Creek Compact has experienced two compliance claims, one involving New Mexico water users and one involving a Colorado reservoir company. Within a few years after the Compact was created, a severe drought gripped the watershed. New Mexico water users

broke locks and destroyed gates in order to divert water. Not only did their actions break New Mexico water law (they were diverting water out of turn), but their actions also violated the water allocation rules of the compact.⁸ The Compact Commission took up the matter. Both the New Mexico and Colorado representatives denounced what occurred and working with the New Mexico State Engineer's Office developed an agreement.⁹ The State Engineer's Office would hire a water master to actively administer water rights in the New Mexico portion of the watershed and the Commission would share the cost of the water master with New Mexico. The commission agreed to take this action because there are a number of points of diversion for Colorado irrigation ditches that are located in New Mexico. Thus, the water master would be administering diversions for both New Mexico and Colorado ditches.

The other compliance claim was much more recent. It was brought by New Mexico water users located near the mouth of the Costilla Creek where it joins the Rio Grande River. The water users did not directly divert water; rather they were interested in maintaining the stream flows. They asked the commission to more actively administer the compact's water allocation rules. The practice of the commission was to allow a Colorado reservoir company to divert water not being used or claimed by anyone else, which would dry up the creek. The citizens attended several compact commission meetings and eventually threatened to file a lawsuit against the compact commission. The commission responded by revising the water master's operations manual to more closely align with the compact water allocation rules.

The remaining five compacts have been before the U.S. Supreme Court with the downstream state instigating the lawsuit, but for one instance. That one instance set precedence for all other interstate river compacts. Shortly after Colorado entered into the La Plata River

⁸ Of course, the New Mexico water users' actions were criminal. However, New Mexico decided not to file criminal charges in part because they could not identify the specific individuals who engaged in the actions.

⁹ It should be noted that the New Mexico representative on the commission is the State Engineer.

Compact with New Mexico, the Colorado State Engineer shutdown the lawful diversions of the Cherry Creek Ditch Company to comply with the water delivery requirements of the compact. The Company sued the State Engineer claiming that its lawful water rights had been violated. Both the Colorado water court and Colorado Supreme Court sided with the Company, ordering the State Engineer to administer state water laws and finding that the Compact was not binding. The U.S. Supreme Court reversed the lower courts and found that compact laws supersede state laws. States were not allowed to pick and choose which aspects of a compact they would abide by or to set aside a compact when it became inconvenient. Compacts were enforceable agreements among states that superseded state laws. Suddenly, vertical linkages representing the capacity of states to regulate their water users became vitally important.

The remaining four compacts highlight the interplay of vertical linkages among state governments and water users. Particular attention will be given to the Arkansas, the Republican and the Pecos.¹⁰ Colorado and Kansas have been before the U.S. Supreme Court over the Arkansas River three times. Twice before a compact was developed and once over a compact compliance issue. One of the water allocation rules of the compact forbids the material depletion of the flows of the Arkansas River. That is, the states were not to develop water in such a way that the flows of the Arkansas River would be changed from their 1948 condition. Beginning in the 1960s two surface water storage projects were planned and eventually built, one on the mainstem of the primary tributary of the Arkansas, and one on the mainstem of the Arkansas, both for the benefit of Colorado water users. Because one of the reservoirs was for flood control and the other for both flood control and the storage of imported water, neither would increase

¹⁰ The Rio Grande, while appearing before the Supreme Court twice at the behest of the downstream states, never experienced a final decision from the Supreme Court. In both instances, the suits were dismissed, however, in both instances the upstream state actively administered its water laws so as to come into compact compliance.

water consumption in Colorado. Nevertheless, Kansas, the downstream state, became alarmed. In addition, Kansas came to suspect that rapid and uncontrolled development of tributary groundwater was also materially depleting flows.

The two states struggled with these compliance issues through the compact commission for almost a decade. While Colorado appeared willing to concede the groundwater issue, the states vehemently disagreed over the reservoirs. In 1985, Kansas filed a suit before the Supreme Court. The Supreme Court appointed a special master who spent a decade developing evidence and working with the states to develop a hydrologic model that would measure the impact of groundwater pumping on river flows. In 1995, the special master made a series of findings, which the Supreme Court accepted, and which addressed all compliance issues. The two reservoirs did not violate the compact, but groundwater pumping in Colorado did cause the material depletion of river flows. Colorado would be required to do two things, regulate all groundwater pumping that occurred after 1948, mitigating its effects on the river; and repay to Kansas, in dollars, the value of some portion of the water that Colorado failed to let pass over the state border because of groundwater pumping.

The Colorado State Engineer acted swiftly. He convened a committee consisting of all of the major groundwater users in the Arkansas River Basin. He worked with the committee to develop a set of groundwater regulations that would limit groundwater pumping unless its effects on the river were mitigated. The vast majority of the committee members signed off on the new rules. Disaffected groundwater users filed suit in water court. After a hearing, the water court found that the rules were acceptable. They did not violate Colorado water law or the state constitution. The State Water Engineer immediately began to implement the rules working closely with the groundwater users. In addition, the state, through the Water Conservation Board,

made available low interest loans to groundwater well associations to lease or purchase surface water to be used to mitigate the effects of groundwater pumping. All of this took place over the course of two years.

Once an authoritative decision was made on compliance issues, Colorado acted relatively swiftly in responding. The state wanted to minimize the damages it would owe Kansas, and the State Engineer had long wanted to regulate wells in order to protect senior surface water rights, however, he lacked the cooperation of well owners. With the Supreme Court decision, well owners realized they could no longer avoid strict regulation and worked with the State Engineer to develop a set of workable rules. One final note, the cost of compliance rests with the well-owners. They are responsible for the costs of leasing or purchasing surface water to mitigate well pumping. If well owners cannot mitigate the effects of well pumping they are not allowed to pump.

Compliance issues in the Pecos River Compact share two similarities with the Arkansas. The vague water allocation rule in the Pecos case, which requires that New Mexico maintain flows of the Pecos at the state line in their “1947 condition”, led to many disagreements over compliance and what it meant, eventually requiring the Supreme Court to weigh in on the matter. Second, once an authoritative decision was made, the upstream state responded swiftly and came into compliance. However, the process by which New Mexico responded was substantially different and water users largely managed to avoid bearing compliance costs.

Once New Mexico and Texas developed a workable model that reliably quantified the “1947 condition”, the New Mexico State Engineer moved quickly to ensure that the appropriate amount of water passed to Texas. The State Engineer acted quickly for several reasons, and not just because he had the authority to do so. First, he wanted to avoid the Supreme Court appointed

river master from administering the Pecos River in New Mexico to ensure compliance. Under the terms of the Supreme Court settlement, an independent third party, the river master, was appointed to monitor New Mexico's compliance with the compact. If New Mexico violated its water delivery obligations, the river master was required to intervene and shutdown water diversions in New Mexico. Presumably, in so doing, the river master would use the prior appropriation doctrine since the compact specifically required New Mexico to govern the Pecos River using the prior appropriation doctrine. Second, and most importantly, the State Engineer never administered water rights in the Pecos River basin according to the prior appropriation doctrine. Instead, he managed the Pecos River so as to satisfy the demands of two large and conflicting irrigation districts and to keep the senior district, which is also the downstream district, from making a call on the river and forcing the Engineer to shutdown junior water users, who largely relied on groundwater, in the upstream district.

Initially, the State Engineer's response was to lease water from the senior, downstream irrigation district, to ensure that sufficient water was delivered to Texas and avoiding water administration by the river master. The State Engineer understood that water leasing was a temporary solution and that a more permanent solution was required. Furthermore, endangered species were listed in the Pecos River basin and additional sources of water would have to be developed to aid in their recovery. With the twin threats of drought and endangered species hanging over the basin, in the mid 1990s, the State Engineer managed to convene a working group representing the major water users and other significant interests in the basin to work out a cooperative plan to make more water available for compact compliance and endangered species. The plan is relatively complex, but it centers on the state legislature appropriating funds to retire farmland and associated water rights, and to invest in irrigation infrastructure projects, such as

lining canals. The costs of compliance mostly rest with New Mexico taxpayers and with the State Engineer. Unlike in Colorado (where the State Engineer, in cooperation with well owners, devised groundwater regulations that required water users to ensure sufficient water each year to meet compact requirements with the Colorado State Engineer monitoring and enforcing compliance), the New Mexico State Engineer, with the assistance of New Mexico taxpayers, is required to ensure sufficient water is available annually to meet Pecos Compact requirements (New Mexico Office of the State Engineer 1998).

Finally, the Republican River Compact and Nebraska's struggle to comply with its water allocation rules exposes the limitations of the co-management structure in the state. Unlike the Arkansas and Pecos River Compacts, the Republican River Compact has a set of well specified allocation rules. Each state is allocated a fixed amount of water. The question that arose was whether groundwater pumping counted against a state's water allocation. Kansas, the downstream state, argued that it did, and, consequently, Nebraska was withdrawing too much water depriving Kansas water users of their share of the river. Nebraska argued that groundwater was not covered by the compact. After more than a decade of discussion and argument in the compact commission, Kansas filed a Supreme Court case. The special master almost immediately found that groundwater was included in the compact. The special master then turned to working with the states to develop a hydrologic model capturing the links between ground and surface water and measuring the effects of pumping on surface water flows. The model is used to track compliance.

With the model in place, the suit was settled, and Nebraska turned to the difficult task of regulating groundwater use. As the Nebraska Natural Resources Director repeatedly reminded the other compact commissioners, the director does not have the authority to regulate

groundwater. Over the last fifteen years, the Governor, legislative leaders, the Natural Resources Director, and individuals representing major types of water users have been struggling to devise, adopt, and implement a series of laws that would allow for strict groundwater regulation and other mechanisms that would promote compliance with the state's compact obligations. Progress has been steady if slow. For instance, it took almost a decade for the legislature to adopt a law allowing the Natural Resources Director to declare river basins over appropriated, triggering a well moratorium. While the legislature struggled, the Republican River natural resource districts issued hundreds of new well permits as farmers raced to build wells, simply exacerbating the compliance issues.

Currently, the Republican River has been declared over appropriated; well moratoria are in place in the natural resources districts; groundwater regulations have been adopted by the districts and approved by the Natural Resources Director. However, the regulations are not sufficient to bring Nebraska into compliance with the Republican River Compact. Consequently, Nebraska "owes" Kansas more than 100,000 acre feet of water, and Kansas is preparing to return to the Supreme Court to revise the earlier settlement so as to ensure Nebraska's compliance.

Nebraska's experience reflects the fragmented nature of the state's water agencies and the state's water laws. Unlike the water law of Colorado and New Mexico, Nebraska's water law does not recognize the hydrologic connection between tributary groundwater and surface water. This fragmentation is in turn reflected in the state's water agencies, with surface water and groundwater governed by different governments. The fragmentation has limited the ability of the state to meet its compact requirements. Natural resource districts have resisted the state's attempt to limit their powers and to force them to share authority with the Natural Resources Department. In other words, building ties and overlaps have been rejected by local water users. A second

Supreme Court case may be necessary to overcome local level resistance and allow the state to more effectively pursue its interests collaboratively with local water users.

Discussion and Conclusion

This paper has aimed to contribute to the burgeoning literature on cross-scale linkages and the growing awareness that even seemingly simple linkages, when considered within the broader governance context, as they interplay with other linkages, can produce complex and unexpected results. Whereas some of the early research on common pool resource governance had considered certain types of cross-scale linkages – namely decentralized authorities and co-management of resources – could support robust resource governance, the current literature acknowledges that such assumptions may be limited. It is not the type of linkage per se that matters, but how the linkage interacts with other linkages in polycentric institutional arenas.

The question of the benefits of decentralization and co-management becomes even more muddled when considering how such linkages interplay with larger-level governance institutions that are established through horizontal linkages. As Young (2002a; 2002b) has shown, these linkages affect the compatibility, competence, and capacity among members of these institutions. In the case of interstate compacts we showed that the standard laws that western US states use for allocating water to their citizens (vertical linkages), impose serious compatibility problems for states to comply with the water laws that they agree upon under the interstate compacts (horizontal linkages). However, our analysis illustrates that other types of cross-scale linkages related to the capacity to administer laws and govern vary in how they affect states' abilities to address compliance problems and ultimately establish greater compatibility between their state water allocation laws and compact laws. Colorado, for instance, which has more polycentric water governance and capacity mechanisms than New Mexico or Nebraska, may initially face

serious compliance problems but is ultimately able to respond quickly and develop robust mechanisms that put the onus on individual water users themselves to comply. New Mexico, on the other hand, while also able to respond relatively quickly, has established state-centric compliance responses that are reliant on the central budget resources of the state, known to ebb and flow as much as the rivers. Nebraska, while decentralized, has fewer polycentric and overlapping ties between the state and water users, has faced serious difficulty both bringing water users into compliance and sustaining that compliance.

While our analysis has provided new insights into the intricate and complex nature of cross-scale institutional linkages, we recognize that much work in the study of cross-scale linkages in transboundary watersheds remains. Our future plans include examining and comparing the costs of compliance under different forms of co-management, and developing lessons for compacts that are just beginning to experience compliance issues. We also plan to continue to develop and refine the measures and indicators of cross-scale linkages, with the hope that these measures can be applied for studying other common-pool resource settings.

Appendix 1: Interstate Water Compact Origins						
Compact	States	Negotiation Time	Pre-compact Conflicts	Pre-compact Problems	Focusing Events	Federal Water Projects
Arkansas River	CO, KS	1945-1949	Kansas v Colorado (1907) KS irrigation districts v CO irrigation districts (1916-1943) Colorado v Kansas (1943)	none	1921 serious flooding between Pueblo, CO and Garden City, KS	Army Corps of Engineers – John Martin Reservoir (1939-1948)
Big Blue	NE, KS	1961-1971	none	Kansas protects major surface water project from water development in Nebraska	none	None of anticipated Nebraska water projects built
Costilla Creek	CO, NM	1941-1946	San Luis Water & Power v New Mexico (1941)	none	none	Privately developed and operated reservoirs only
La Plata	CO, NM	1919-1922	CO irrigators regularly dried up river leaving no water for NM irrigators	none	none	No noteworthy public or private reservoirs
Pecos	NM, TX	1941-1945	Early 1920s TX irrigators fear river depletions caused by NM irrigators	1935 TX agrees to NM water project in exchange for negotiating compact	1941 serious floods	Fort Sumner Dam and Reservoir, NM
Republican	CO, NE, KS	1934-1943	none	none	1930s severe drought ;1935 serious floods	Harlan County Reservoir, NE
Rio Grande	CO, NM, TX	1925-1938	Early 1900s conflict between US & Mexico; conflict between NM irrigators and TX irrigators; 1933 Texas v New Mexico	1929 temporary compact	none	Elephant Butte Reservoir, NM
South Platte	CO, NE	1921-1923	1916 NE irrigators v CO irrigators	none	none	none

Appendix 2: Interstate Water Compacts' Allocation Rules

Compacts/ Water Source	Seasonality	Rule Type	Water Amount	Users Subject to Compact Administration
Arkansas (Colorado, Kansas) - 1949				
<i>native flows above reservoir</i>	Nov 1 – March 31	fixed	All water flowing into reservoir is stored, but for 100cfs	
<i>native flows below reservoir</i>	April 1- Oct 31 (stored water available)	proportionate	CO up to cfs; KS between cfs and cfs	
<i>native flows below reservoir</i>	April 1 – Oct 31 (no stored water available)	No allocation to Kansas	Sufficient to meet CO water rights, remainder stored in reservoir	
<i>native flows in Colorado (not covered by above rules)</i>	none	Fixed – hydro regime	No material depletion of flows at state line	CO appropriators 1948 & later (applies to native flows & tributary groundwater)
<i>Stored water</i>	April 1-Oct 31	proportionate	60% Colorado; 40% Kansas	
Big Blue (Kansas, Nebraska) - 1971				
<i>Big Blue native flows</i>	May 1 – Sept 30	Fixed - minimum downstream	NE provides minimum daily stream flows	NE appropriators, Nov 1, 1968 and later
<i>Little Blue native flows</i>	May 1 – Sept 30	Fixed - minimum downstream	NE provides minimum daily stream flows	NE appropriators, Nov 1, 1968 and later
<i>Big Blue native flows</i>	Oct 1 – April 31	None	NE has free and unrestricted use of water	
<i>Little Blue native flows</i>	Oct 1 – April 31	None	NE has free and unrestricted use of water	
Costilla Creek (Colorado, New Mexico) – 1944, Amended 1963				
<i>Native flows</i>	May 16 – Sept 30	Proportionate	CO receives up to 51.42 cfs; NM receives up to 88.28 cfs	
<i>Reservoir Water</i>	May 16 – Sept 30	Proportionate	CO receives 36.5%; NM receives 63.5%	
<i>Surplus Flows</i>	May 16 – Sept 30	Proportionate	Each state receives 50%	
<i>Native Flows</i>	Oct 30 – May 15	Storage season		
La Plata (Colorado, New Mexico) - 1922				
<i>Native Flows (above 100 cfs at state line)</i>	Feb 15 – Dec 1	None	Both states have unrestricted use of water	
<i>Native Flows (below 100 cfs at state line)</i>	Feb 15 – Dec 1	Proportionate	CO delivers 50% of flow at Hesperus gage to state line	CO appropriators
<i>Native Flows</i>	Dec 1 – Feb 15	None	Both states have unrestricted use of water	
Pecos (New Mexico, Texas) - 1949				
<i>Native flows, flood water, groundwater</i>		Fixed - minimum downstream	NM delivers to TX a quantity of water equivalent to that available to TX under “1947 condition”	
<i>unappropriated flood water</i>		Proportionate	NM 50%; TX 50%	
<i>Salvage water</i>		Proportionate	NM 57%; TX 43%	
Republican (Colorado, Kansas, Nebraska) - 1943				
<i>Native flows & tributary</i>		Fixed – all states	CO receives 54,100AF; NE receives 234,500AF; KS receives	NE appropriators from 1948 & and

<i>groundwater</i>			190,300AF	later
<i>Unallocated native flows</i>		Proportionate	NE 48.9%; KS 51.1%	
Rio Grande (Colorado, New Mexico, Texas) - 1938				
<i>Native flows & tributary groundwater</i>		Proportionate	CO separate delivery schedules for Rio Grande and Conejos Rivers as function of flows; NM delivery schedule from CO state line to Elephant Butte Reservoir as function of flows	CO and NM appropriators
South Platte (Colorado, Nebraska) - 1923				
<i>Native flows</i>	April 1 – Oct 15	Fixed - minimum downstream	CO will provide 120cfs per day at state line	All CO appropriators from Washington County east to state line with water rights of June 14, 1897 & later
<i>Native flows</i>	Oct 16 – March 31	None	CO has unrestricted use of water	

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