

Analyzing decentralized resource regimes from a polycentric perspective

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Abstract This article seeks to shed new light on the study of decentralized natural resource governance by applying institutional theories of polycentricity—the relationships among multiple authorities with overlapping jurisdictions. The emphasis on multi-level dynamics has not penetrated empirical studies of environmental policy reforms in non-industrial countries. On the contrary, many of today’s decentralization proponents seem to be infatuated with the local sphere, expecting that local actors are always able and willing to govern their natural resources effectively. Existing studies in this area often focus exclusively on characteristics and performance of local institutions. While we certainly do not deny the importance of local institutions, we argue that institutional arrangements operating at other governance scales—such as national government agencies, international organizations, NGOs at multiple scales, and private associations—also often have critical roles to play in natural resource governance regimes, including self-organized regimes.

Keywords Developing countries · Decentralization · Local governance · Institutions · Natural resources management

Forestry has always been important in the Bolivian municipality of San Rafael. For many years, however, most forest extractions were unchecked and often illegal.¹ Landowners relentlessly expanded their agricultural fields by clearing forest. Groups without

¹ The story of San Rafael is described in more detail in Andersson (2002).

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government permits logged the area extensively. Some of these illegal loggers sometimes exchanged gunfire to gain access to valuable timber. The central government in charge of enforcing the many formal rules and regulation of forest use was virtually absent. This produced a situation in which the most powerful forest users, such as the large landowners and private forestry firms, were left to dictate who had access to the most valuable areas of the forest. In this regime, subsistence farmers—who represent the majority of residents in San Rafael—were largely excluded from forest management activities.

In 1996, the Bolivian decentralized forest policy helped to change most of that. Mayor Romelio Ortiz used his new powers to create a 220,000-ha municipal forest reserve and helped establish forest management plans incorporating the concerns of landowners and forest users. He also invited a variety of actors with a stake in the local forest resources to help plan future municipal support activities in the forestry sector. These governance efforts produced noticeable changes in outcomes. For instance, one leader of a previously illegal logging group now runs a legitimate forestry operation and sells sawed wood to buyers around the country.

Mayor Ortiz's efforts and success in the forestry sector fulfill the hope of a new decentralized approach to natural resource governance that has spread around the world. Until the 1970s, central governments tended to view natural resource governance as a top-down affair—as a means towards industrialized development. Given the perceived failure of these top-down policies, decentralization policy is now a highly touted response to the difficulties of forest governance. Local governments, it is thought, can better administer policies because they are more familiar with both the local environment and needs of local users. Dozens of countries implemented decentralized natural resource management programs in the 1990s. By 2003, the World Resources Institute identified sixty countries where decentralization was an important component of natural resource policies (WRI 2003).

In spite of the decentralization euphoria of the 1990s, the actual outcomes of decentralized policies adopted around the world have been very mixed. In fact, just two hundred miles down the road from San Rafael, a darker side of decentralization appears. In the municipality of Samaipata, the substantial increases in the municipal government's power and resources have not produced noticeable improvements for the majority of the inhabitants. If anything, the decentralization reform in that municipality seems to have further strengthened the dominant group of political and economic elites. The ruling elite has invested in urban infrastructure improvements rather than worrying about rural people's access to and management of natural resources. One observer notes that "The municipal work plan includes infrastructure for the town and for the tourism industry, but ignores the needs of the majority of the municipality's population: the rural poor. The municipal officials, who are tightly linked to the tourism industry, either forgot about the demands from the farmer organizations or they simply ignored them" (Flores 1998, p. 418).

Recent studies support the mixed anecdotal evidence presented above. Formal decentralization efforts do not uniformly lead to better or worse local governance (see Blair 2000; Gibson and Lehoucq 2003; Larson 2002; Nygren 2005; Ostrom 2001; Pacheco and Kaimowitz 1998; Smoke 2003). Even in Bolivia—hailed as a decentralization success story by two United Nations organizations (FAO 1999; UNDP 1998)—the outcomes are extremely mixed (Andersson 2002; Pacheco 2000, 2007). The diverse outcomes in countries that have decentralized their natural resource governance regimes raise an important question for public policy analysts: Why do local governments in decentralized regimes respond so differently to their assigned roles?

In this article, we draw on institutional theories of *polycentricity*—the relationships among multiple authorities with overlapping jurisdictions—to address this question. Since V. Ostrom, Tiebout, and Warren introduced the term in 1961, a growing body of theoretical literature has developed on polycentric governance (McGinnis 1999a, b, 2000; Oakerson 1999; Ostrom 2005). This literature has made the case that the study of political systems needs to consider the degree and forms of *nestedness* of political actors within larger political systems. The patterns of interaction and outcomes depend on the relationships among governance actors at different levels and the problems they are addressing.

No perfect governance arrangement exists. All governance institutions are imperfect responses to the challenge of collective-action problems. Because these imperfections may exist at any level of governance, we argue that analysts should consider the extent to which complementary back-up institutions exist at higher or lower levels of governance that can help offset some of the imperfections at any one level. Scholars interested in polycentricity engage in multilevel analyses of how actors at different levels of governance interact and influence each others' decision making (Bickers and Williams 2001; Hooghe and Marks 2003; Sproule-Jones 1993). This emphasis on multilevel dynamics has not yet, however, penetrated empirical studies of decentralized reforms in non-industrial countries. The purpose of this article is to lay out an analytical agenda for the study of decentralized governance of natural resources from a polycentric perspective and provide some initial evidence consistent with this approach.

We focus our exploration on the relationships between particular characteristics of multilevel interactions and variations in public service performance among local governments—some of which have received new powers and some of which have not. We assume that a governance system that manages to distribute capabilities and duties in such a way that perverse incentive and information problems at one level are offset to some extent by positive incentives and information capabilities for actors at other levels, will achieve better outcomes than either a highly centralized or fully decentralized system.

We start this theoretical exploration by discussing the social dilemmas that are associated with the governance of complex natural resources, such as forests, and then examine how polycentric governance theory helps to analyze these socio-ecological systems. After reviewing the core hypotheses in the existing decentralization literature we use the polycentric approach to identify previously understudied areas of significant importance for both theory and public policy concerned with decentralization, and formulate two theoretical propositions in the form of empirically testable hypotheses. We then examine these propositions empirically in a comparative framework that includes three different policy regimes: Bolivia, Peru, and Guatemala. We conduct a set of partial tests of our hypotheses and discuss the results of our comparative analysis. In the conclusion, we identify areas that represent opportunities for future research.

The challenge to govern complex natural resources

As human populations and their demands on natural resources continue to grow, citizens and officials from around the world search for effective solutions to govern common-pool resources, such as forests, fisheries, and river basins. Natural resources that are common-pool resources (CPRs) are a particularly difficult natural resource to govern (Ostrom and Nagendra 2006). As such, it is costly to exclude others from using these resources while one person's harvest leaves less for others to harvest. CPRs combine the most problematic

aspects of resource governance since they are subtractable like private goods, and have high costs associated with excluding outsiders, like public goods. Hence, the effective management of these resources remains one of the most difficult tasks facing modern public policy (Dietz et al. 2003).

Several natural resource systems, such as forests and river basins, are also complex natural systems. They produce multiple goods and services, sometimes hundreds—each of which has its own set of inputs and outputs in its production. And the production of goods is often non-linear. Each of the goods may have its own distinct spatial ranges at any point in time. Each may interact with other goods. Some may have more resilience than others when responding to interruptions to their production. Such complexity challenges any attempt to create institutions to manage natural resources, especially those that propose free-market privatization, top-down centralized control, or bottom-up decentralized control as the “only” way to organize (Ostrom 2007).

Many policy reforms attempt to streamline government organizations—a strategy that often makes the resulting governance structure *less* able to deal with complexity of resource problems. Constitutional systems that generate adequate information at multiple scales and provide legitimate decision-making procedures without being too complicated for the different actors involved have a better chance of succeeding in the challenges to govern common-pool resources than simple, streamlined systems at any one scale. Hence, it seems necessary, in the interest of policy efficacy, to take a broader analytical approach that takes into account multiple scales of governance.

Collective-action problems are present in all efforts to govern common-pool resources, regardless of whether a particular system has a centralized or decentralized governance structure. The conditions for addressing these problems effectively, however, may be quite different depending on how decision-making authority is distributed throughout the system’s structure. In the next section, we look at the pros and cons of a fully decentralized structure in addressing some of these fundamental problems.

The problem of promoting decentralization as *the* solution

Whether examined in the context of formal federal structures or the informal rules of rural communities, scores of books and articles now laud the positive effects of local governance. Such work is also consonant with the current development thinking of donors and multilateral lending agencies (e.g., IDB 1994; OECD 1997; World Bank 1988, 1997) that now fund scores of projects incorporating decentralization as at least part of their goals.

Why may a series of relatively autonomous, self-organized, resource governance systems do a better job of managing their natural resources than a single central authority? Drawing on Ostrom (2005), we outline the potential advantages of local systems of governance and the disadvantages of *fully* decentralized systems. Decentralization is, in many respects, a reaction to earlier efforts to centralize the governance of natural resources.

In the 1970s and 1980s, a widely shared presumption was that the single best method for governing natural resources was transferring ownership and responsibility to large-scale, national governments (see, e.g., Grainger 1993). It was thought that only a strong central government was capable of constraining citizens’ demand for resources, which—if unabated by the central powers—would eventually lead to the destruction of the resources. By the end of the last century, however, an increasing number of scientific studies challenged the centralist view of natural resource governance, showing that numerous local user groups have successfully self-governed their natural resources (see Aoki 2001; Feeny

1988; Higgs 1996; Lam 1998; National Research Council 1986, 2002; Ostrom 1990). Some analysts saw these studies as support for a strategy to turn over *all* governance responsibilities to local users and consequently pushed for extensive decentralization reforms (even though that was not advocated in the empirical literature). Those infatuated with the local sphere came to expect that local actors are always able and willing to govern their natural resources effectively. While sufficient evidence exists that local users *can* self-organize in many settings to develop effective governance mechanisms, the capabilities of a governance system that is strictly organized horizontally at a local level are limited.

Previous research pointed to several advantages of local governance regimes for common-pool resources. The most commonly cited is local knowledge: users who have lived with and harvested from a resource system over a long period of time will have developed relatively accurate mental models of how their biophysical system operates, since their harvesting success efforts depend on such local knowledge (Hayek 1948; Ostrom et al. 1993; Oates 1985; Hilton 1992). Because of this local knowledge, local users are more likely to craft better-adapted rules for local common-pool resources than any general system of rules for a larger array of resource systems (Tang 1992, 1994). Letting local users devise their own rules, they may create rules that limit access to the resource, encouraging inclusion of participants who are trustworthy and exclusion of individuals who are not. Such rules will, in turn, increase the probability that participants will trust each other more and use positive reciprocity (Rabesahala Horning 2005). This lowers the cost of relying entirely on formal sanctions and hiring many guards (Gibson et al. 2005b). Precisely because local users have to bear the cost of monitoring in a decentralized system, they are apt to craft rules that make infractions highly obvious so that monitoring costs are lower (Ostrom 1990). Another advantage of local governance is its reliance on disaggregated knowledge. Feedback about how the resource system responds to harvesting is provided directly and rapidly (Acheson 2003; Wilson 2002). Fishers are aware, for example, of changes in the size and species distribution of their catch over time (Wilson 1990; Palsson 1998). Finally, the probability of failure throughout a large region is greatly reduced by the establishment of parallel systems of rule making, interpretation, and enforcement. While some groups may fail to govern successfully, others do so. Thus, the redundancy of local units means that the more drastic costs of a failure of a centralized unit over a large terrain are offset by other local successes (Ostrom 1999).

Limitations exist, however, to all ways of organizing the governance of resources. Although the existing research is far less voluminous on the failures of fully decentralized systems, limitations do exist. For example, in a fully decentralized system, governance relies on the self-organization of local resource users and for some local users self-organization is too costly (Meinzen-Dick 2007). While the evidence from the field is that many local users do invest considerable time and energy in their own regulatory efforts, some do not. Many possible reasons exist for why some groups do not organize or stay organized, including a reduced dependency on the resource (Baker 2005), considerable conflict among users (Libecap 1989), high political costs (Gibson and Lehoucq 2003), lack of leadership (Johnson 2001), and fear of having their efforts overturned by higher authorities (Epstein 1997; Shivakumar 2005). Given the complexity of the design task, some groups will select rules that do not work well together and consequently generate failure (Berkes 2007). Perhaps the most commonly cited source of failure of a decentralized system is the problem of local tyrannies (Platteau 2004; Platteau and Gaspart 2003; Andersson and van Laerhoven 2007; Johnson 2001). Not all self-organized resource governance systems will be organized democratically or rely on the input of users. Some will be dominated by a

local leader or elites who only change rules for their own advantage. This problem is accentuated in locations where the cost of exit is particularly high and reduced where users can leave.

Another disadvantage of a fully decentralized system is the risk of stagnation. Where local ecological systems are characterized by considerable variance and complexity, experimentation can produce unexpected results leading users to cling to systems that have worked well in the past and stop innovating long before they develop new rules likely to lead to better outcomes (Acuna and Tommasi 2000). This complexity is difficult for users to handle especially if they have limited access to scientific information. While time and place information may be extensively developed and used, local groups may not have access to scientific knowledge concerning the type of resource system involved. Finally, conflict among user groups are not only more likely to occur in a decentralized system where the local rights to govern resources are stronger, but those conflicts are also more likely to be more difficult to manage because of the limited access to external conflict-resolution mechanisms (Alston et al. 1999). Conflict within and across common-pool resource systems may escalate and provoke physical violence. Two or more groups may claim the same territory and may continue to make raids on one another over a very long period of time.

The disadvantages associated with fully decentralized governance arrangements have been used by some scholars to argue for the centralization of natural resource governance (Herring 2001). Yet, others have made similar lists of the advantages and disadvantages of *centralized* governance only to conclude that a decentralized governance structure is the best way of dealing with the perceived failures of centralization (Lebel 2006). We suggest that both views are right to point out the problems as well as opportunities associated with either approach. We disagree, however, with prescriptions of either entirely centralized or entirely decentralized governance systems because the adequacy of a particular governance structure depends on several context-specific attributes. As analysts, we argue, it is important to recognize the inherent imperfections in all human governance arrangements, decentralized or centralized, for dealing with complex resource problems.

In highly decentralized structures, one of the main challenges is how to design institutions and policies so that elected local officials have an incentive to support local resource users to manage resources in a sustainable manner (Gibson and Lehoucq 2003; Lutz and Caldecott 1997; Ribot 2002). In centralized systems, one of the main difficulties is to devise rules that are effective in a variety of different local circumstances, including different local peoples' needs, norms, problems, and knowledge, as well as the characteristics of the resources that they use (Fitzpatrick 2006). Given these imperfections, it is more productive for both analysts and decision makers to accept that no single structure is necessarily superior to the other. The feasibility of any given governance structure is likely to depend on a series of context-specific factors, such as the nature of the resource to be governed; the extent to which local resource users are organized to create, monitor, and enforce the rules for resource use and management; and the degree to which actors who are subject to these local organizational arrangements interact and collaborate with other actors who are external to the community.

The challenge, then, is to design institutional systems that simultaneously capitalize on the advantages of a particular governance arrangement while relying on institutional backup systems that can help offset the imperfections (Sayer and Campbell 2004). The task of analysts is to sort out the design of such complex systems through careful empirically-grounded analyses. The polycentric analytical approach can help the analyst with this task.

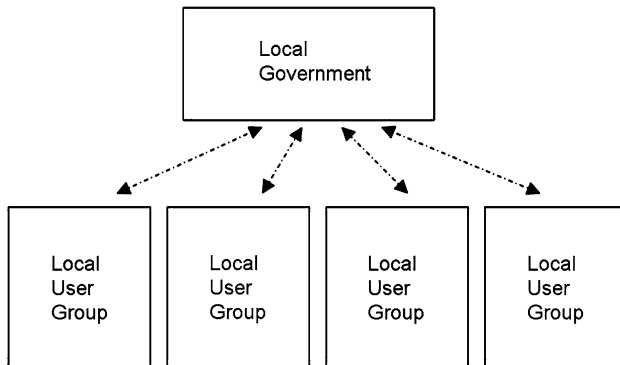


Fig. 1 The underlying conceptual model for conventional studies on decentralized resource governance

The polycentric approach for analyzing multiscale governance

The empirical studies on decentralized governance, which we reviewed in the previous section, have been extremely important in informing the policy community about the particular conditions under which local governance will have a higher likelihood of succeeding. One of the current limitations of this literature, however, is the scope of analysis. Most of these studies focus on a particular level of governance and often limit the study to the decisions and actions of one particular governance actor within that level, such as a local government administration, a neighborhood organization, or a rural community. In a more limited set of studies in the area of decentralized resource governance, the focus is expanded to include the relationships between the “local government” (whether a formal governmental organization at the regional and municipal levels, or a local community) and local resource user groups. Figure 1 illustrates the analytical scope of these studies.

Although the polycentric approach to the study of governance systems has principally been applied to the study of collective goods in metropolitan areas of the United States (but see Ostrom et al. 1993 for applications to developing countries), we argue that a polycentric perspective on natural resource governance can provide several additional lessons that are useful for policy analysts. The main difference between conventional and polycentric approaches to the study of decentralized resource regimes is the scope of analysis. To explain decentralization outcomes, a polycentric analyst looks beyond the performance of a local government unit to consider the relationships among governance actors, problems, and institutional arrangements at different levels of governance, as illustrated by Fig. 2.

The institutional design of a given governance system can be more or less polycentric. In the real world, no perfect polycentric system exists. We refer to polycentric governance as a theoretical construct. As such, it is a broad type of a governance regime that possesses a number of specific institutional attributes capable of providing and producing essential collective goods and services to the citizens in that regime. It is a system that seeks to unleash the ingenuity, and stimulate the creativity, of political entrepreneurs. It is a system that is structured so that actors within the system are given opportunities for institutional innovation and adaptation through experimentation and learning.²

² For an early discussion of types of goods, see Ostrom and Ostrom (1977). For more recent discussions, see Aggarwal and Dupont (1999), Gibson et al. (2005a), Ostrom (2005), and Martin (1995).

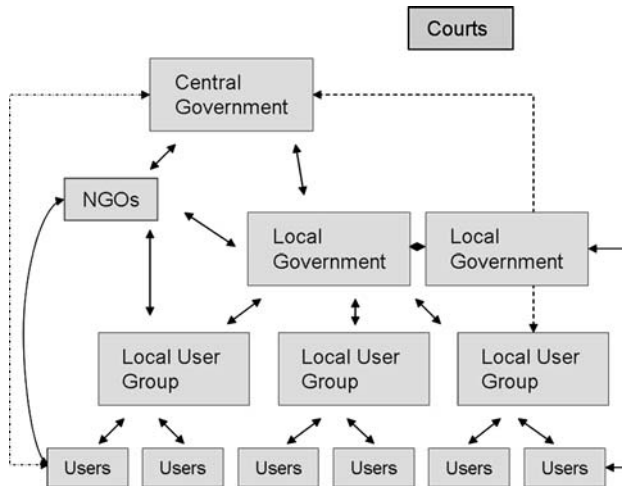


Fig. 2 The conceptual model of decentralized resource governance from a polycentric perspective

The polycentric governance approach challenges the blueprint governance model of a one-size-fits-all. All human efforts to govern natural resources face the problem of creating rules that make sense for the particular social, biophysical, and institutional context in which the resources exist. When policymakers create generalized rule systems that may not fit the local context well, the incentives of users to manage resources responsibly are considerably weakened. The polycentric approach studies the conditions for interactive learning between local user groups and between these groups and government officials. As such, it assesses the degree to which the governance process actually helps the actors to craft and adjust their own rules over time, thus increasing the likelihood of these rules being effective in regulating resource use.

Highly polycentric systems are themselves complex, adaptive systems without one central authority dominating all of the others in regard to all policy arenas. Thus, there is no guarantee that such systems will find the combination of rules at diverse levels that are optimal for any particular environment. In fact, one should expect that all governance systems will be operating at less-than-optimal levels given the immense difficulty of fine-tuning any complex, multitiered system. A key aspect of all proposals for increased polycentricity (as opposed to *just* centralization or *just* decentralization) is the effort to enable institutions of multiple scales to more effectively blend local, indigenous knowledge with scientific knowledge (Berkes and Folke 1998; McGinnis 1999b). The key to the successful design of such institutions is their multiple scales and their generation of information that allows participants operating at many different scales to learn from experience. The complexity of the environments involved is simply more than any single corporate entity can absorb and manage.

What institutional attributes are of special interest to a polycentric scholar? A polycentric analytical approach studies the conditions for developing adaptive systems where each has some degree of autonomy to cope with one set of discrete policy arenas. The approach assumes that governance arrangements are more effective when citizens are able and authorized to self-organize not just one but multiple governing authorities at differing scales (see Ostrom 1991, 1997, 2008; Ostrom et al. 1961). Another key assumption is that the self-governing capabilities of groups of citizens should form the basis for the design of

wider-scale institutional arrangements, such as those making regional public policies and constitutional laws. In a polycentric governance system that is operationalized to a greater or lesser extent in the world of public affairs, each unit exercises considerable independence to make and enforce rules within a circumscribed scope of authority for a specified geographical area. In such a system, some units are general-purpose governments while others may be highly specialized. Self-organized resource governance systems, in such a system, may be special districts, private associations, or parts of a local government. These are nested in several levels of general-purpose governments that also provide civil, equity, as well as criminal courts.

The polycentric approach to the study of natural resource governance compares the characteristics of a given governance system—such as the decentralized forestry regime in Guatemala or the highly centralized natural resource governance regime in Peru—with that of either fully centralized or decentralized systems or other existing systems in practice. Such comparisons yield observations of policy outcome variables as well as specific variables related to the organization of the governance arrangements that are either somewhat similar or different across systems. These observations help the scholar to construct hypothetical explanations for what institutional attributes make a particular system work better or worse than others for dealing with particular problems. As such, one of the strengths of the polycentric approach is the generation of *ex-ante* hypotheses about the importance of particular attributes of institutional design as related to the specifics of the resources involved. In the next section, we start to formulate such hypotheses, building upon existing empirical findings on decentralized natural resource governance in developing societies.

Central hypotheses in decentralization research

Consistent with the research on polycentric governance, the decentralization literature has found that one of the main barriers to successful decentralization reforms is the frequent lack of opportunities provided by these policies to local resource users when it comes to acquiring and exercising effective control over the resources that they use (see, e.g., Agrawal and Ribot 1999; Crook and Manor 1998; Gibson et al. 2000; Smoke 2003). Another example of findings from the decentralization literature that resonates with polycentric governance theory is related to the importance of institutional mechanisms for citizen participation. Several existing studies describe how inclusive decision making in decentralized local economies increases the quality of public services (Ackerman 2004; Cohen and Rogers 1995; Fung and Wright 2001; Goldfrank 2002), improves responsiveness and accountability of local government (Blair 2000; Fiszbein 1997; Goldfrank 2002; Ribot 1999), and even enhances equitable access to services and productive assets (Hardee et al. 2000; UNDP 2002). Without the possibility of local resource users voicing their preferences and sharing their local expertise in the local decision making over resource policies, the informational advantages of a decentralized governance structure are foregone.

Table 1 compares the conventional decentralization research with that of the polycentric governance approach and highlights some of the contrasting features of each. This comparison highlights the fact that a polycentric approach—and particularly its emphasis on relationships between governance actors who operate at different levels of governance—points to several areas that are still largely unexplored by decentralization scholars. Among these, we particularly note (1) multiscale analysis and institutional incentives, and

Table 1 Comparison of the distinguishing features of conventional and polycentric approaches to the study of decentralization

Defining characteristics	Mainstream decentralization literature	Polycentric analytical approach
Unit of analysis	Local <i>government</i>	Territorial focus, local <i>governance</i>
Policy aspect emphasized	Scope, fit, <i>or</i> environmental outcomes	Scope, fit, <i>and</i> environmental outcomes
Key variables	Accountability, financial, and human capacity	Underlying incentive structures

(2) decentralization as treatment. Next, we discuss the core issues within each of these areas and start to develop testable hypotheses for each of these.

Multiscale analysis and institutional incentives

The realization that the relationships between different governance actors are important influences on a local government's performance has implications for the unit of analysis chosen in a research design. In the search for viable explanations to the variable outcomes of decentralized resource governance, most existing empirical studies consider the local government administration as the appropriate unit of analysis (i.e., Blair 2000; Fiszbein 1997; Larson 2002). We argue that future empirical analyses would benefit from widening the unit of analysis from the local *government administrative unit* to the local *governance system*.

The logic behind this argument is that the individual characteristics of local governments are often insufficient to explain the variation in governance outcomes in decentralized regimes. Bolivia's 1996 forestry regime is a case in point, as the formal governmental authority to govern this sector is split up between six different organizations. None of these organizations have the full legal mandate or sufficient human and physical resources to govern the sector unilaterally. Hence, to be effective, the mandated actors at different levels of governance would need to build institutions for communication and reciprocal cooperation through which they can combine their resources and efforts. Also, the positive incentives to invest in natural resource governance are seldom generated internally within the local government administration itself, but rather through accountability mechanisms that govern the relationship between the local government and other governance organizations at different levels, such as central government agencies, community-based organizations, and non-governmental organizations.

One of the core findings of the extant literature on decentralized natural resource governance is that effective decentralized governance requires that local governments possess sufficient internal institutional capacity to be able to operate adequately (Ellis and Mdoe 2003; Fiszbein 1997; Gow and Morss 1988; Larson 2002; Leighton 1996; Lewis 2003; de Oliveira 2002; Smoke and Lewis 1996; Warren and Issachar 1983; Wirtshafter and Shih 1990). To carry out its mandated functions, whatever these might be, local governments need to have a certain level of financial resources, qualified personnel, and the ability to organize their internal affairs. It is the lack of institutional capacity, these scholars argue, that limits the potential of decentralization as a performance-enhancing strategy in the non-industrialized world.

In the polycentric approach, technical capacity and financial resources are important but secondary to contextual institutional incentives. The reason incentive structures are given

so much weight is the realization that local politicians face significant governance dilemmas that often make their decisions to invest in natural resource governance quite costly. A central dilemma of environmental governance is that local actors often need to bear a substantial part of the costs associated with the conservation of natural areas, while reaping only a small part of the benefits. As analysts, we should not take local actors' interest in any form of governance activity for granted, especially when it comes to environmental governance. This collective-goods dilemma raises an important question: Why would local politicians be interested in natural resource governance?

Drawing on earlier empirical work (Andersson 2003; Andersson et al. 2006; Gibson and Lehoucq 2003), we suggest that only local politicians who face positive incentives are likely to respond to decentralization reforms by making the required investments. On the other hand, if they do face such incentives, they are also predisposed to seek out better options for acquiring the needed human and physical forms of capital, making them more likely to also achieve a greater policy impact. We hypothesize that one of the strongest predictors of a local political leadership responding to decentralization reforms by investing in natural resource management activities is the incentive structure for local politicians. More precisely, we view these incentives as emerging from the interactions between local politicians on the one hand, and the resource users, central government representatives, and other non-governmental organizations on the other. The nature of these incentives can be monetary (i.e., perceived financial gains or losses resulting from a particular course of action), but may also be political (i.e., perceived possibilities for re-election, increased legitimacy among constituents) and social (i.e., perceptions of changed social standing and prestige among peers).

Following the findings of recent studies by Gibson and Lehoucq (2003), Andersson (2003), Larson (2002), and Andersson et al. (2006), we formulate the following hypothesis, which will later be tested with empirical observations:

H1 Local governance executives (mayors) are more likely to support and invest in municipal natural resource governance when they perceive clear institutional incentives to do so, regardless of the degree of decentralization.

In our econometric model, we include two variables that represent institutional incentives: the perceived importance of financial transfers from the center to the local government when it comes to natural resources as well as the number of meetings related to natural resource management between the municipal officials and the local community-based and non-governmental organizations. Our expectation is that the stronger the vertical relationships are between municipal government actors and local resource users (as measured by the frequency of interactions) as well as central government agencies (as measured by financial transfers) in the area of natural resources, the more committed the local governance system will be to invest activities related to the governance of natural resources.

Decentralization as treatment

Many existing studies rely on research designs that make it very difficult to isolate the effects of decentralization reforms on resource governance outcomes. Most studies are qualitative, in-depth studies of local government experiences in single countries or sub-national regions for a single point in time (Larson 2002; Pacheco and Kaimowitz 1998; Andersson 2004; Nygren 2005). While such studies can offer rich and detailed hypotheses

about the institutional conditions for effective decentralized governance, they do not capture any variation with respect to decentralization. As a result, the analysis of decentralization effects in such studies is often speculative. We suggest that one way of overcoming this obstacle is to compare regimes with differing degrees of decentralization. In this article, we compare one highly decentralized (Guatemala), one semi-decentralized (Bolivia), with one highly centralized regime (Peru).

This design allows us to analyze whether it is more productive to have a policy design that devolves a restricted mandate than a mandate that gives extensive decision-making authority to local governments. In 1996, both Bolivia and Guatemala decided to decentralize some governance responsibilities in their forestry sectors to their respective municipal governments. Peru, on the other hand, has not, until very recently, implemented any decentralization reforms, and represents our baseline—a pre-decentralization case. There are also differences in the degree of decentralization between Bolivia and Guatemala. The Guatemalan central government opted for handing over vast decision-making authority to the municipal governments; their Bolivian colleagues were much more restrictive in their decentralization—only authorizing Bolivian municipalities to regulate some very specific functional areas. This research design enables the comparative analysis to assess the potential influence on policy outcomes of three different doses of decentralization treatments.

Previous research has suggested that a major constraint for effective decentralized decision making is that central governments rarely give up enough power or provide sufficient support to local authorities (Adamolekun 1991; Agrawal and Ribot 1999; Bahl 1999; Bird and Vaillancourt 1999; Blair 2000; Crook and Manor 1998; Gibson 1999; de Mello 2000; Parry 1997; Prud'homme 1994; Smoke 2003). Central governments may even use the guise of *de jure* decentralization policies to extend their *de facto* centralized authority (e.g., Gibson 1999; Murombedzi 2001), or to pass off a costly policy to subunits without the necessary administrative support (Adamolekun 1991; Agrawal and Ribot 1999; Bahl 1999; Bird and Vaillancourt 1999; Blair 2000; Crook and Manor 1998; Gibson 1999; de Mello 2000; Parry 1997; Prud'homme 1994). But many of these studies do not use subnational data to examine the variable effects of decentralization, even in places where such reforms have devolved extensive governance responsibilities and resources to local actors. The studies that do draw on systematic subnational data have found that there is often great variation in outcomes at the local level (Andersson 2003; Andersson et al. 2006; Larson 2002; Pacheco and Kaimowitz 1998). Comparing forestry sector decision-making at the local level in Bolivia and Guatemala, Andersson et al. (2006) found that mayors in Guatemala are more likely to invest in forest governance programs than their Bolivian colleagues. The reason, the authors argue, is that the mayors in Guatemala's more decentralized regimes enjoy more opportunities to reap both political and financial benefits from forest sector investments. Drawing on the idea that decentralization may affect institutional incentive structures, we formulate the following hypothesis:

H2 The effect of upward political pressure on local politicians to invest in natural resource governance activities will be stronger in more decentralized regimes than in less decentralized regimes.

We measure decentralization as a three-level ordinal variable, representing different “dosages” of decentralization. Guatemala is the most decentralized regime in our sample and as such, all Guatemalan local governments are assigned a value of 2. Bolivia is the semi-decentralized case, and has been assigned a value of 1. Local governments in Peru, which exist in the most centralized of the three countries, represent the baseline case and

have as such been assigned a value of zero. Given the evidence from previous empirical studies, we would expect that the effect of bottom-up pressure, as measured by the frequency of interactions between local governments and CBOs/NGOs, is stronger for the more decentralized regimes. In the next section we take our hypotheses—developed using the polycentric approach—and test them using a large number of empirical observations in Bolivia, Guatemala, and Peru.

Empirical analysis: the cases of Bolivia, Guatemala, and Peru

Bolivia, Guatemala, and Peru are ideal cases for a comparative study of decentralized natural resource governance. While they share a number of essential biophysical, socio-economic, historical, and cultural characteristics, they also differ on one of the main variables of theoretical interest in this article: decentralization. All three countries are Latin American, poor developing countries with large rural and indigenous populations, significant natural resources, high proportion of forest cover, frequent land use-related disputes, and locally elected mayors. But the three countries differ a great deal when it comes to the degree of decentralized governance structure in each country's natural resource sectors. The amount of regulatory power that each national government grants to its local governments fits along a continuum between a great deal of local decision-making autonomy (Guatemala), to moderate amounts (Bolivia), to virtually no local decision-making power in the natural resource sectors (Peru). Table 2 summarizes and compares the municipal mandates in natural resource governance in the three countries.

Table 2 Comparison of local government mandates in natural resource governance

Attributes	Peru	Bolivia	Guatemala
Length of term	5 years	4 years	4 years
Possibility of re-election?	Yes	Yes	Yes
Ownership of natural resources	Central government, with limited usufruct rights to citizens	Central government, with some usufruct rights to citizens	Central government, but with extensive usufruct rights for communities and private individuals
Authority to create municipal regulations for resource use	No	Limited to zoning	Yes
Authority to raise taxes and service fees for natural resources	No	No	Yes
Governance responsibilities in natural resource governance	No	Yes	Yes
Financial transfers for natural resource governance responsibilities	No	Yes	Yes

Source: Authors' elaboration based on national governments' legal documents as well as Nickson (1995) and Zaz Friz Burga (2001)

In 1996, both Bolivia and Guatemala passed their reformed forestry laws, which laid out the details of the effort to decentralize several tasks and responsibilities in the sector from central to municipal governments. Despite the reforms, Bolivian municipalities are not allowed to collect any taxes on forestry activities, charge user fees for services produced, or impose fines on individuals who are caught disobeying the government laws and regulations. Guatemalan municipalities, in contrast, may own, manage, and even rent out their forests. Within municipal and communal forests, Guatemalan municipalities are authorized to regulate and tax forest use as they see fit, as long as the local rules do not contradict the national forestry law.

In Peru, at the time of our fieldwork in 2002, there was no decentralization of governance responsibilities to municipal governments at all, and the central and regional governments retained complete formal control over the natural resource sectors' decision-making process.³ By selecting countries with different degrees of decentralization, we are able to analyze the effects of decentralization on local politics.

Quantitative data analysis

There are three major data sources for this article: (1) in-depth personal interviews with the elected mayor in 300 randomly selected municipalities in the three countries (2000–2002), (2) census/archive data (2000–2002), and (3) qualitative, in-depth case studies of selected municipalities and resource-user communities in Bolivia and Guatemala. To obtain data about local government institutions and actions, we conducted field surveys for a randomly selected 100 municipal governments in Bolivia (out of a total population of 320), and 100 in Guatemala (out of a total population of 331), as well as another 100 in Peru (out of a total population of 1,881 district governments). In each selected municipality, we interviewed the elected mayor who held office during the 1996–2000 term. Each face-to-face interview took approximately 1.5–2 hours. The survey instrument (258 questions) was designed to elicit information regarding the mayor's policy priorities, staff, relationship with central and non-governmental agencies, and relationship with natural resource users and citizens at-large.⁴ It uses a variety of techniques to understand mayoral incentives and behaviors. We included several quality-control questions in the surveys, which we checked for reliability by comparing the mayors' responses with archival data. We found the survey instrument to be highly reliable. In addition to this survey data, the research teams in all three countries have collected structural and socioeconomic information for each municipality, originating mostly from sub-national census data and national forestry sector databases for harvesting permits, taxes, royalties, management plans, etc. We analyze the influence of a total of seven independent vari-

³ This started to change in 2003 when the Government of Peru started to decentralize the governance responsibilities for various natural resources, including forests.

⁴ The interview instruments for Peru were slightly different from those applied in Bolivia and Guatemala. The Peruvian interviews focused on natural resource governance more broadly, while in the other two countries, interviewers asked more specific questions about decisions and activities in the forestry sector. Notwithstanding, for the purposes of analyzing why local government actors would commit scarce resources to natural resource governance activities, the interview data from all three countries is compatible because of identical ways of measuring the variables of interest in this article.

ables on local responses to decentralization reforms and use multivariate regression techniques to test our three theoretical propositions.

Dependent variables

Our empirical tests employ two outcome variables that seek to capture different aspects of a local governance system's commitment to invest in natural resource governance. The first dependent variable is called "Natural resource management (NRM) personnel" and measures the percentage of the municipal government personnel that works with issues related to natural resource management. The second dependent variable, which is called "Natural resource management (NRM) priority" measures whether the mayor views natural resource governance as a political priority for the municipal administration, as expressed by the mayor during our personal interview. For the first regression model, which uses "NRM personnel" as its dependent variable, we use Ordinary Least Squares regression (with robust standard errors). Because the dependent variable in the second model is a binary variable, we use binary logit regression.

Independent variables

Our discussion of the contributions of a polycentric approach to the study of decentralized natural resource governance suggests that there are two causal processes that have been largely overlooked in the conventional empirical literature on decentralization. Our approach seeks to remedy this shortcoming by including representations of multiscale interactions as well as decentralization as treatment. First, we include variables that measure the interactions between actors at three different levels of governance: financial transfers from the central government to the municipal government in the area of natural resource governance and political pressure from local community-based organizations (CBOs) and non-governmental organizations (NGOs) working on NRM. Our theoretical prediction is that without a multilevel analytical approach, our explanations of variation in local political responses to decentralization will be less powerful. Because the multilevel interactions characterize relationships between actors with different positions of authority, these variables capture important incentive structures related to political accountability. We posit that these are crucial determinants of the local mayor's political commitment to natural resource governance.

Second, by including a large number of local governments from three regimes with different degrees of decentralization, our empirical analysis tests for the influence of the decentralized governance structure itself on the level of local NRM commitment. By including an interaction term between the decentralization and CBO–NGO meetings variables, we test whether the effect of local political incentives differs depending on the degrees of decentralization.

The validity of our analysis depends to a great extent on the degree to which we take alternative explanations into account and control for these in the comparative analysis. We therefore include three control variables that previous studies have found to be important determinants of local political outcomes related to natural resource governance. The three control variables are: the financial endowment of the municipality, the mayor's level of education, and the municipality's population density. Table 3 presents the main characteristics of all dependent and independent variables.

Table 3 Descriptive statistics for municipal governance systems in Bolivia, Guatemala, and Peru

Variables	Description	<i>n</i>	mean	st dev	min	max
NRM personnel	Proportion of municipal staff assigned to issues related to natural resources	299	0.79	1.14	0.00	1.00
NRM importance	Whether natural resources are priority to the mayor	296	0.57	0.49	0	1
Decentralization	Guatemala = 2, Bolivia = 1, Peru = 0	299	1.00	0.82	0	2
Central funding	The importance of financial transfers from the central government according to mayor	299	1.12	1.40	0	5
Population density	Inhabitants per km ²	299	88.96	223.2	0.12	3,084
Mayor's education	Years of schooling	299	9.91	4.70	0	18
Municipal income	Annual revenues in USD 1000's per capita	299	0.04	0.04	0.00	0.53
Meetings with NGOs and CBOs about NRM	Number of monthly meetings between MG officials and CBO/NGOs	299	4.24	2.49	0	10

Results

The results of the two econometric models are presented in Table 4. These results lend support to the polycentric approach for the study of decentralized natural resource governance. By applying multiscale analysis, we identified institutional incentives originating from interactions between actors across governance levels as important determinants of local government interest in natural resource governance. The coefficients for the institutional incentive variables are positive and statistically significant in both models and seem to explain part of the observed variance in local government performance in the natural resource sectors across the three countries. Hence, the results fail to reject the

Table 4 Results for regression with robust standard errors (Model 1) and binary logistic regression (Model 2)

Variables	Model 1: NRM personnel	Model 2: NRM priority
Decentralization (a)	−0.007 (0.006)	0.214 (0.209)
Central funding	0.019 (0.005)***	0.291 (0.108)***
Population density	0.000 (0.000)	0.001(0.001)
Mayor's education	0.001 (0.001)	0.032 (0.029)
Municipal income	0.390 (0.164)**	4.020 (4.277)
Meetings with NGOs and CBOs (b)	0.005 (0.002)**	0.242 (0.066)***
Interaction term (a × b)	−0.001 (0.003)	−0.097 (0.066)
Intercept	−0.014 (0.014)	−1.689 (0.398)***
F (<i>P</i> -value)	5.074 (<i>P</i> = 0.000)	–
Likelihood ratio χ^2 (<i>P</i> > χ^2)	–	50.89 (<i>P</i> = 0.000)
R ² Adjusted (M1), Pseudo (M2)	0.159	0.126
Variance inflation factor	1.391	–
<i>N</i>	299	296

Coefficients are listed with standard errors in parenthesis

*** *P* < 0.01

** *P* < 0.05

hypothesis that local governance executives (mayors) are more likely to support and invest in municipal natural resource governance when they perceive clear institutional incentives to do so, regardless of the degree of decentralization.

More specifically, the robust regression results from model 1 show that for each additional meeting about natural resources that the municipal staff holds with local CBOs and NGOs, provokes a 0.5% increase in the proportion of municipal staff dedicated to NRM. This is consistent with the results from model 2, which employs binary logistic regression techniques. By calculating the changing probabilities of placing high political priority on natural resource management for the different values of this independent variable, we get a sense of the effect of this variable. When interactions with local organizations are at the minimum level, the probability of observing high priority given to natural resources is just over 0.33, but when these interactions are most frequent the same probability increases to 0.85.

The source of the other institutional incentive in our model—the financial transfers from the center to local governments—shows a similar effect on the local political commitment to natural resource governance. The more important that the mayor perceives the financial transfers from the central government to be for the municipal natural resource program, the higher the proportion of natural resource staff in the municipal government. A one-unit change on the five-level ordinal scale that measures the importance placed by the mayor on financial transfers corresponds to a 1.9% increase in the proportion of municipal staff working on natural resource issues. Similarly, when the importance of financial transfers changes from its lowest level in our sample (1) to its highest (5), the likelihood of observing natural resources as an issue of utmost priority for the municipality increases from a probability of 0.50 to over 0.81. The analysis suggests that these two sources of political and financial incentives matter for the performance of local governance systems, whether those systems are decentralized or not.

Our second hypothesis stated that the effect of upward political pressure on local politicians to invest in natural resource governance activities will be stronger in more decentralized regimes than in less decentralized regimes. We test this hypothesis in two ways. First, we consider whether the degree of decentralization has any significant direct effect on the two dependent variables in our models. If it does, it would suggest that the local political and financial commitments to natural resource management depend directly on the degree of decentralization. The second test of the hypothesis consists of letting the decentralization variable interact with the variable measuring frequency of meetings with NGOs and CBOs, which represents a proxy variable for upward political pressure in the municipality. If this interaction term is significant, it would suggest that the effect of the upward political pressure on local commitments to NRM depends on the degree of decentralization. As the results in Table 4 show, however, neither the decentralization variable nor the interaction term is significant. It is interesting to note that the sign of the decentralization variable coefficient, albeit statistically insignificant in both models, is actually negative in Model 1 and positive in Model 2. This curious result suggests that the effect of national-level policy regimes depends on the specific outcome measure considered.

Based on the results of both these tests, we reject our second hypothesis and conclude that the degree of decentralized governance structure does not seem to exert any systematic influence on the two different outcome measures. Decentralization reform alone is not a strong predictor of local political commitments to natural resource governance. The results also suggest that the characteristics of local institutional arrangements, which govern the interactions between municipal authorities on the one hand and local groups and central

government actors on the other, provide powerful explanations to the variability in local commitments to natural resource governance, regardless of the formal structures of governance at the national level.

These results speak to the main question raised in the introduction: Why do local government actors in decentralized regimes respond so differently to their assigned roles with regards to natural resource governance? Our empirical analysis indicates that the reason is related to the varying institutional contexts in which these actors are embedded. In the area of natural resource governance, the relationships between municipal actors and local resource users as well as national government agencies largely define the institutional context. This means that the municipal actors in different institutional contexts are likely to perceive very different financial and political payoffs with regards to their investment decisions in natural resource governance.

Conclusion

The complexity of many natural resources requires sophisticated governance systems. Actors who try to govern a complex resource face a variety of incentives that often complicate collective efforts and subsequent outcomes. The more complex the resource is, in terms of the types of goods and services that it provides, the more perverse incentives are likely to exist unless a well-tailored set of institutional arrangements offset these incentives. Some actors may be tempted to shirk from their contributions to the governance arrangements by not attending meetings or not paying the membership fees. Others may actively try to weaken the institutions so that they can use the resource with fewer constraints. A sophisticated governance system recognizes the multiscale aspects of natural resource governance as well as the presence of countervailing incentives, and seeks to correct them. As analysts of such governance institutions, we need approaches that recognize and capture such complexities.

As the physical scale of the resource changes, so do the types of collective goods that the resource offers to users (ranging from private goods of harvested fuelwood at the microscale to global public goods of maintenance of a stable forest gene pool or storing carbon in trees to stabilize the climate). To govern a process that can provide incentives to users to safeguard the long-term delivery of such a variety of goods requires more than financial resources and accountability mechanisms at any one level of governance. Our argument explores the need for multilevel governance arrangements that rely on the explicit recognition that incentives at some scales may be incompatible with goods and services produced at a different scale.

One of the few findings in the decentralization literature with which most scholars agree is that large variation in policy outcomes exists within countries that have decentralized their governance of public goods and services. Even though more and more studies conduct comparative analyses of subnational governance systems, there is still little or no consensus in the decentralization literature about which factors explain this variation. Many extant empirical studies do not go beyond the boundaries of local governments to examine why some local units perform better than others under the decentralized regime. In this article, we have argued that there are several institutional factors that are likely to determine the effectiveness of a governance system and that these are related to processes that are larger than the internal dynamic of a particular governmental administration. We suggest that the key to effective governance arrangements lies in the relationships among actors who have a stake in the governance of the resource.

The results of our empirical analysis support this notion. The results of the two regression models suggest that a polycentric approach, by considering the interaction between actors at different levels of governance, can contribute to a more nuanced understanding of the factors that drive the variation in decentralized governance outcomes. It is important to recognize, however, that the empirical analysis carried out in this article represents an incomplete test of merely two theoretical propositions originating from this analytical approach as applied to the study of decentralization. While the results suggest to us that this is a productive way of looking at decentralized resource governance, the analysis faced several important constraints that future work should seek to address. First of all, we lacked data on governance outcomes. In fact, the two dependent variables used in our regressions measure perceptions of local commitments to carry out governance activities—such as resource use regulation, monitoring, and enforcement activities—rather than the results of those governance activities. Future studies should seek to measure what some of those outcomes are, including how the natural resource base might be changing as a result of local actors' governance activities. Thanks to remote-sensing technology, it is now possible to create time-series observations of forest cover change for essentially any forest in the world over the past 35 years. This development represents an opportunity to polycentric scholars interested in testing the environmental effects of decentralization reforms.

Ecological outcomes are a function of complex interactions between natural, socio-economic, and institutional processes. To study how the institutional structure—in terms of decentralization—might influence the environment, one of the most difficult challenges for future decentralization studies is the need to control for the influences of natural and socioeconomic processes that also shape ecological outcomes. This is easier said than done because the three processes often interact and influence each other at the same time as impacting the environment. The environment-related rules that people create and agree to follow often depend on people's socioeconomic situation (i.e., to what extent their basic needs rely on resource extraction) as well as the biophysical nature of the resource itself (i.e., the scarcity and salience of the resource).

To deal with this complexity, we suggest that explanatory models include variables that capture each of the three intertwined processes, as well as explicit interaction terms and feedback loops that capture the dynamics of these relationships. This raises another issue for future research: investing in the collection of longitudinal data that would make it possible to carry out a more dynamic analysis of the effects of particular institutional arrangements on local efforts of resource governance in different contexts. We believe that one of the biggest and most important challenges for polycentric scholars today is to develop more dynamic analyses of how local institutions respond to local contexts and affect ecological processes.

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