

Comparing Forest Decentralization and Local Institutional Change in Bolivia, Kenya, Mexico and Uganda

Eric A. Coleman
Florida State University
Department of Political Science
P.O. Box 3062230
Bellamy 543
Tallahassee, FL 32306-2180
ecoleman@fsu.edu
Tel: 850-644-4540
Fax: 850-644-1367

Forrest D. Fleischman
Indiana University
Workshop in Political Theory and Policy Analysis
513 North Park
Bloomington, IN
fleischf@indiana.edu

Jacqueline Bauer
Indiana University
Workshop in Political Theory and Policy Analysis
513 North Park
Bloomington, IN
jacmbaue@indiana.edu

Acknowledgements

We wish to acknowledge generous financial and administrative support from the Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program (SANREM), the Workshop in Political Theory and Policy Analysis, and the International Forestry Resources and Institutions Program. Additional funding for Forrest Fleischman's work on this project came from a National Science Foundation Graduate Research Fellowship. We thank Krister Andersson and Elinor Ostrom for extensive comments on the drafts of this paper, as well as our collaborators in Mexico, Bolivia, Uganda, and Kenya, who worked so hard to gather this data. Any remaining errors are our own.

Comparing Forest Decentralization and Local Institutional Change in Bolivia, Kenya, Mexico and Uganda

Summary. – In this paper we assess the institutional and environmental impacts of forest decentralization in Bolivia, Kenya, Mexico, and Uganda. Although decentralization is often described as if it were a single policy intervention, many different types of reforms have been described as decentralization. We develop theories of institutional impacts based upon the specific decentralization reforms within the context of each country, and then argue that decentralization impacts are moderated by a country-specific control variables. Using data from the International Forestry Resources and Institutions Program, we estimated the effects of forest decentralization on local forest investments, rulemaking, wealth inequality, and forest conditions.

Key words – Bolivia, Kenya, Mexico, Uganda, Decentralization, Forestry

1. INTRODUCTION

Forest decentralization programs have rapidly spread in developing countries in the last twenty years (Agrawal, Chhatre, & Hardin, 2008; Andersson, Gibson, & Lehoucq, 2004). In this paper we argue that the impacts of decentralization on forest users' behavior are context dependent. Decentralization policies do not affect forest user behavior directly – rather they change local incentive structures by altering tenure security, user autonomy, and the power structure of local governance – which in turn lead to behavioral change. Thus, although general predictions about the outcome of decentralization are likely to fail, predictions based on understanding how reforms alter existing local incentive structures are more likely to be successful.

Furthermore, decentralization policies may change patterns of local governance that produce a variety of outcomes, some desirable and some not. For example, if property rights are devolved to diverse forest users, the new property rights holders may hesitate to invest in forest resources if they fear that these changes are temporary; at the same time wealth inequality may be mitigated from such a policy. Thus, to provide an accurate assessment of the effects of decentralization, one should examine a suite of relevant variables that might be altered. The characteristics of decentralization in different contexts allow one to hypothesize about how various outcomes will be affected.

Rather than a unified theoretical approach that would explain decentralization in all contexts, we argue that the effects of decentralization need to be understood according to specific contexts and according to the outcomes one assesses. We test the effects of forest decentralization drawing on data collected by researchers of the International Forestry Resources and Institutions program in four countries that have experienced forest decentralization reforms in the past 20 years – Uganda, Kenya, Bolivia, and Mexico. Our hypotheses on the effects of decentralization depend upon the context of decentralization in each country and the outcome measure employed.

Research on forest decentralization, like much of the broader literature on decentralization, is plagued by analytical problems. First, decentralization is not a single, well-defined policy but rather a general term that is applied to a diversity of policies that may include some combination of (a) moving

bureaucrats from central locations to sites closer to resources; (b) increasing the decision-making discretion of local level bureaucrats; and (c) increasing the decision-making authority of local users (Cohen & Peterson, 1996). Second, while there are a large number of theoretical arguments relating to the benefits and costs of decentralized political orders, under closer scrutiny these fail to generate consistent predictions (Andersson et al., 2008; Treisman, 2007). Third, decentralization policies interact with numerous other pressures to change governance institutions, forest user behavior, and resulting forest conditions and livelihood outcomes (Andersson et al., 2008). The connection between national policy changes and changes in local level behavior are mediated by complex processes that inhibit policy implementation in even the best of circumstances (Pressman & Wildavsky, 1978; Sabatier, 1986). Forest management, an activity frequently undertaken in remote and politically marginal areas of poor countries, is not a promising candidate for implementation success.

Not surprisingly, evaluations of forest decentralizations have reported disappointing results. The most influential theoretical work in this area is Agrawal and Ribot's (1999) framework, which emphasizes the importance of actors, powers, and accountability on the influence of decentralization reforms on governance institutions.¹ Work in this tradition has led to the pessimistic conclusion that decentralization reforms have reinforced the power of the central state (Ribot & Larson, 2005; Ribot, Agrwal, & Larson, 2006; Larson & Ribot, 2007). This literature approaches the problem of implementation from a top-down approach: they ask how central actors and local power brokers interact through the process of reform. While this approach undoubtedly has advantages for understanding the political context of decentralization, it has led the authors of these studies to largely ignore behavioral changes among forest users in their empirical investigations.

This paper seeks to address this gap by explicitly analyzing changes among forest users on the ground, placed within the larger political context of national decentralization policies. While we do not suggest that the focus on national and regional policymakers is mistaken, we do suggest that we can learn still more about decentralization if we understand how changes filter down to local level users. We argue that predictions about the effects of decentralization policies on user behavior are not adequately captured

by a general theory, but instead must derive from attention to the details of how such policies interact with the existing political order and biophysical structures to change incentives at the local level.

We investigate the effects of decentralization on the investment decisions, rulemaking, wealth inequality, and forest conditions as seen by local user groups. We hypothesize different effects of decentralization in the four countries under study, dependent on the specific types of reforms adopted in the countries as well as differences in user group and forest characteristics. We find that the effects of decentralization differ substantially across countries.

The paper is organized as follows. In the next section we review the history of decentralized forest reforms in general and specifically in each of the four countries. These case histories provide the basis for our theoretical predictions of the impact of decentralization on our outcome variables. In Section 3 we draw on existing theory to derive predictions of the effects of decentralization in each of the countries. In Section 4 we describe the data we use for our analysis as well as summary statistics for each of the four countries. In Section 5 we report our empirical results. In Section 6 we discuss these findings and in Section 7 we conclude.

2. A BRIEF HISTORY OF DECENTRALIZATION

As a starting-off point for our analysis we first briefly review the history of decentralization policy as initiated by development agencies, and then turn to the decentralization reforms in our four countries: Bolivia, Kenya, Mexico, and Uganda. These countries were selected because they represent diversity in terms of region and age and type of reforms, and because community level data on forest management and community governance is available in all four countries through the International Forestry Resources and Institutions program.

(a) Decentralization as a development agency policy

Development agencies have long been advocates of decentralization reforms in developing countries. While many have begun to acknowledge concerns about decentralization outlined in the literature, support for the principle remains. The World Bank website indicates that “there is a strong rationale for decentralization in terms of economic efficiency, public accountability, and empowerment”

as well as benefits of allocative efficiency and the empowerment of communities, individuals and others (World Bank, 2009). Similarly positive statements are made by the U.S. Agency for International Development and the European Union (Dininio, 2000; Bossuyt, Hauck, & Keijzer, 2007). These agencies also acknowledge the dangers of decentralization, including elite capture, corruption, principal agent problems, when and how to provide support to decentralization processes, and how to conduct assessments of success. While this shows that development agencies acknowledge many of the concerns expressed in the decentralization literature, such policies continue to be adopted. A sound understanding of how local user behavior changes in response to these policies is also needed.

(b) Bolivia

Andersson and Pacheco (2004) divide the history of forestry policy in Bolivia into three periods. First, from independence in 1825 until 1953 central government presence in the forested lowlands was minimal. Indigenous communities managed their own affairs, but their tenure was threatened by the central state, which could appropriate land and resources as political patronage to elites (primarily from the more politically powerful highlands). These formal allocations of property rights often conflicted with indigenous systems.

After the 1952 revolution, the Bolivian central government instituted land reforms that titled fifty hectare plots in the lowlands to poor highlanders, but the system was not very effective and many colonists turned to land clearing as a method of clearly marking their territory (Andersson & Pacheco, 2007). Forestry was not recognized as a land use under the land reform laws, nor were indigenous rights to the land. Combined with the short timeline and political manipulation associated with forest concessions, this period was marked by strong incentives for forest clearing (Pacheco, 2007).

Market-oriented and municipal government reforms took place from 1985 through 1995, expanding both the participatory nature and political power of municipalities, including the forestry sector. Then, in 1996, an agrarian reform and a forestry law were passed. These were the first laws in Bolivian history to recognize forestry as a legitimate land use for all property owners, and to recognize the harvesting rights of indigenous communities. These policies specify that the Bolivian government

owns all forest resources, with private ownership restricted to plantations and permits granted for commercial harvesting activities (Andersson & Pacheco, 2004).

Prior to 1996, de jure control of the forest sector rested exclusively with the central government. The new set of forestry institutions attempted to introduce checks and balances between numerous actors. The most powerful of these actors was the newly created forestry superintendence, a politically independent central regulatory agency. Some power also rests with the Ministry of Sustainable Development and Planning, and municipal governments are given control over monitoring, administration and technical advice. Municipal governments have no authority to tax the forestry sector, but they are supposed to receive 25 percent of the money from central government forestry taxes, including a one USD tax per hectare on logging concession holders. In the vast majority of municipalities, this amount of money is insufficient for the purposes it is supposed to support (Andersson, 2002).

Municipal governments hold other powers to engage in land use planning through participatory processes that may play an important role in planning in the forestry sector (Andersson, 2002). In addition, the governance institutions of indigenous communities have been empowered to play a much more active role in forestry planning, including commercial timber harvest (Pacheco, 2007).

(c) *Kenya*

The colonial government of Kenya created a forest department in 1902, which alienated most prior existing community-managed forests. Forest policies for most of the century, both before and after independence in 1963, focused on insuring Forest Department control over resources. Following independence, a series of donor-funded forestry programs focused on afforestation and reforestation on farms, with the goal of alleviating fuel shortages. Forest Department lands were managed with no consultation outside of the agency. Conflicts increased in the late 1980s between communities, who needed fuelwood from neighboring forests, and the agency (Ongugo & Njuguna, 2004).

A broad decentralization began in 1983 with the establishment of the “District Focus for Rural Development” system, which delegated responsibility for numerous rural development projects to the local districts. However, policymaking, planning, and funding decisions largely remained centralized

within government ministries. Local districts (and their associated county councils) had limited accountability to local people (Omondi & Omosa, 2002; Poole & Leakey, 1996).

The New Forest Act of 2005 replaced the Forest Department with the Kenya Forest Service (KFS), a semi-autonomous body managed by a board made up of representatives from various central government ministries. Under the Act, the KFS is expected to devolve powers to the private sector and to forest conservation committees and community forest associations (CFAs). Community participation, achieved primarily through CFAs, and integrated management of forests are central principles motivating the new policy (Ongugo, et al., 2008). Because the 2005 law went into effect in early 2007, the formation of CFAs and other responses to the law's requirements are still evolving.

(d) *Mexico*

The process of decentralization in Mexico differs from the processes in Kenya, Bolivia, and Uganda due to Mexico's history of communal land tenure. Agrarian reforms in the Mexican Constitution of 1917 set in motion the creation of *ejidos* and *comunidades*. *Ejidos* were newly created communities with collective rights to land, governed by local councils in collaboration with the central government, while *comunidades* were indigenous communities who had prior rights. In both cases, the national government claimed ownership of the land, with the community receiving long-term rights to use the land.² Most *ejidos* were created in two periods: 1934-1940 and 1958-1976. The result of these reforms is that roughly 80 percent of Mexico's forest is governed under some form of common property (Klooster, 2003). Thus, Mexico's forest decentralization built on existing modes of center-local collaboration (de Janvry, et al., 2001).

Beginning in 1986, there were a series of changes in forest policy in Mexico, with a new forest law in 1986, new forest and agrarian laws in 1992, and additional changes in forest laws in 1997 and 2003. Prior to 1986, the central government managed forest land within *ejidos* and *comunidades*, granting concessions to private logging. Since the communities could not control or realize profits from forest land within their boundaries there were strong incentives for community residents to clear forests for agricultural use. The 1986 law ended private concessions, required more detailed environmental

studies for logging permits, and authorized communities to hire their own forest engineers to develop management plans—all services that had been monopolized by the government (Bray et al., 2006).

The 1992 agrarian reform was a fundamental legal restructuring of the ejido. Ejidos were given the choice to privatize all or part of their common agricultural holdings, and were given much greater management rights (e.g., rights to rent land or offer concessions). References to state ownership were removed, and ejidos became de facto full owners of the property. The dividing up of forest parcels was prohibited – if an ejido voted to dissolve, its forest would become property of the state. Finally, the ejidos were allowed to set up sub-communal enterprises as well as joint enterprises with outside ventures (Gordillo, de Janvry, & Sadoulet, 1998).

Both the 1986 and the 1992 forest laws were written with limited consultation; however, the 1997 law resulted from public dialogue (Bray et al., 2006). The 1997 law attempted to fix problems in the 1992 law, whose focus on plantations failed due both to global market conditions and to the inherent problems of establishing large scale commercial plantations on scattered communally managed forest lands. It included the first formal program to support community forestry since the 1980s.

The 2003 law, like the 1986 and 1992 laws, were the result of bureaucratic initiative, not popular demand. The chief effect of the 2003 law was to greatly expand institutional support and funding for community forestry initiatives (Bray et al., 2006). While decentralization in Mexico has been a much more gradual process than in the other countries discussed here, we have chosen to focus on the most recent reform in our analysis, in part because of the availability of data.

(e) *Uganda*

Until the late 19th century, forest rights in Uganda were the province of communities, clans, and kingdoms. In 1894, Uganda became a British protectorate, and in 1898 the colonial government began a series of interventions that shifted forest rights and responsibilities among several entities, often undermining traditional rights. The country adopted its first national forest policy in 1929, with significant amendments to the policy taking place in 1938 and 1948 (Turyahabwe & Banana, 2008).

After independence in 1962, a two-tiered system of forest reserves was set up. Local forest reserves—typically small, non-commercial areas—were managed by district government authorities for the benefit of local people. Central forest reserves were managed by the forest department for regional benefits, and were larger and more commercially oriented. In 1967, with the adoption of a new, republican constitution, local forest reserves were abolished and authority over all local forests was centralized (Namubiru, 2008; Turyahabwe & Banana, 2008).

President Yoweri Museveni took control at the end of the civil war in 1986 and later introduced decentralization programs in an attempt to consolidate his power (Boone, 2007). In 1993, forest management was decentralized to District governments under the Local Government Statute. Local governments were able to retain fees from logging, but also incurred significant new expenses for permitting and administration. This led them to increase logging to generate revenue. The Forest Department complained that local governments were overexploiting their forests, and recentralized the forests in 1995.

A new process of forest sector reform was set in motion in 1999, resulting in a new forest policy in 2001, a national forest plan in 2002, and the National Forestry and Tree Planting Act in 2003 (Turyahabwe & Banana, 2008). The 2001 policy explicitly recognized the rights and interests of communities and individuals and was seen as an improvement over previous policies. Under this policy, in 2003, the Forest Department was reorganized into a semi-autonomous National Forest Authority (NFA), with control over central forest reserves, which constitute approximately 15 percent of the forests. While some areas were set aside for conservation, the NFA is also engaged in planting fast-growing exotics and commercial harvesting to achieve fiscal independence. The NFA is supposed to share 40 percent of its revenue with the local governments, in exchange for help with monitoring, but little trickles down to the parish level.³

The 2001 policy also created the District Forest Authority to manage the remaining forested lands. In practice, not all districts have an officer, and those that do frequently do not employ sufficient staff or resources to help the officer achieve stated goals. The 2003 forestry law emphasizes setting up

community forest management groups and providing incentives for forest management on private lands, but a lack of funding has slowed this process. Nevertheless, decentralization and improved participation have been the articulated goals of forest policy for the last two decades.

3. HYPOTHESES

For reasons explained in the introduction, general theories of decentralization do not lead to coherent predictions about the outcomes of reforms. Instead, we argue that predictions must be derived from understanding how new policies alter the incentives facing local actors. We first review the broad theoretical arguments for and against decentralization. These arguments tend to present themselves as general theories of decentralization, without accounting for the context and type of decentralization reforms being implemented. We then develop a nuanced set of hypotheses of the effects of decentralization based upon the historical background and substance of the particular decentralization reforms.

Arguments in favor of decentralization can be grouped into two broad categories. The first sees decentralization as an end: decentralized orders are expected to increase public participation in democratic decision-making, which is a normatively desirable goal. Decentralization policies may be politically demanded by resource users who wish to have greater control over their resources.⁴ The second category of arguments for decentralization sees decentralization as a means to the end of creating improved administrative function and service delivery. In this second category, public participation in democratic decision-making is only one of several mechanisms which are expected to contribute to improvements, although some authors, such as Ribot (2008) argue that the democratizing reforms of the first category are necessary preconditions. Decentralization is expected to create a competitive environment for governmental functions, thereby stimulating agencies towards more efficient production.⁵

There are reasons, however, to be skeptical of potential improvements from decentralizing resource governance to communities (Treisman, 2007). Most governmental functions occur in noncompetitive environments, and even if they were competitive, could lead to a “race to the bottom”

rather than a “race to the top.” Not all resource users in fact possess useful local knowledge (Corbridge & Jewitt, 1997). Also, empirically there is no evidence that formally established community-based resource management performs any better, or any worse, than private or state resource management (Hayes, 2006; Coleman, 2009).

In this paper we will evaluate decentralization policies as being an end in itself as well as being a means to an end. Most decentralization policies (including the policies implemented in the study countries) have the dual goals of both making resource use sustainable and improving rural livelihoods (Andersson, Gibson, & Lehoucq, 2004). In order to evaluate the effects of decentralization policies, we compare four separate criteria before and after decentralization in each country. We evaluate the frequency of forest investments and the willingness of forest users to make rules, indicators of decentralization as an end in itself. Forest user participation in rulemaking and investment in forest resources (indicating that users are sufficiently satisfied with the reforms so that they trust they will realize a return at some date in the future) indicates an increase of democratic governance of resources. We next evaluate wealth inequality and the perceived forest conditions, which speak directly to the decentralization end goals of sustainable forest use.

It is important here to note that the unit of analysis in this paper is a user group, defined as a set of individuals with the same rights and responsibilities to forest resources. User groups are connected to particular forests within each country and might be formal organizations such as formally constituted forest associations or informal sets of individuals who use the forest to harvest fodder. Thus each of our evaluation criteria are in reference to particular forest users groups in each country.

Because decentralization reforms differ across countries and because of the different contexts within which these reforms were passed, we expect that decentralization will have different impacts across countries. In Table 1 we summarize our hypotheses as described in the remainder of this section.

[TABLE 1 ABOUT HERE]

(a) Forest investments

To identify the potential effects of decentralization on user group investments in the forest, consider the incentives members of the user group face when deciding to make such investments. Our outcome variable is measured by the investments (planting seeds, trees, or bushes) that user groups undertake in the forest. Once a user group member plants seeds they must wait a period of time before realizing the returns from the investment. Therefore, we expect that reforms which increase users' tenure security or available capital will induce users to increase their levels of investment, controlling for other factors.

In Uganda we hypothesize that decentralization will have no impact on such investments, after controlling for scarcity and other site-specific contextual factors. Prior to decentralization there were very few forest investments. The decentralization process decreased the security of users' tenure, with the forest being decentralized then recentralized a number of different times in the decade prior to final decentralization. Investment levels could not decline under decentralization simply because they were absent to begin with, but we would not expect them to increase, because of the instability of the reform and the uncertainty it created. Also, because the central forest authority was all but eliminated in the decentralization process, we would expect few subsidies available to communities for these investments.

In Bolivia, Kenya, and Mexico, on the other hand, we expect investments to increase after decentralization once controlling for scarcity and other contextual factors. In each case, decentralization enhanced tenure security and/or capital availability. One might expect that investments in Mexico would not change because the decentralization reforms were relatively modest compared to the other countries; however, the reforms stipulated increased funding from the forestry department to communities which we will show were used for forestry-related investments. In Bolivia and Kenya, while there was little money from the central forestry departments, the reforms created property rights for local users that were previously nonexistent. We hypothesize that this incentivizes locals to invest in these resources as they are now more assured to realize the gains from their investments.

(b) *Rulemaking*

Rulemaking can be seen as another type of investment, however its political nature means that factors other than tenure security and capital availability will influence rulemaking. Rulemaking represents a commitment to meet and discuss the future of the community. Here we make no claim as to the efficacy of such rules, but merely refer to the fact that user groups are investing time to come together and create rules. Increased rulemaking has been found to correlate with resource scarcity (Ostrom, 1990). User groups are also more likely to engage in rulemaking when they believe that they have legitimate authority to make such rules, and when they are actively engaged in monitoring and sanctioning (Coleman & Steed, 2009).

In Uganda we hypothesize that decentralization will positively affect rulemaking, after controlling for other factors. While we expected no effect on forest investments, there is reason to believe that communities have a strong incentive to come together and make rules in an environment where the macro-level rules are ambiguous or unstable, and where forest resources are scarce, as they are in Uganda. While rulemaking requires an investment of time, unlike natural investments it generally does not require an investment of capital.

In Kenya and Bolivia we hypothesize that the creation of new forest management institutions, which granted rights to users who had never previously had recognized rights to organize or make rules, will lead to a large increase in rulemaking.

The 2003 decentralization reform in Mexico was more a culmination of many years of decentralization rather than a clear distinction from previous regimes. As such, Mexican user groups had extensively engaged in rule making for the past fifty years. Even before decentralization, more than 70 percent of the user groups in our sample were actively making rules. There is little reason to expect that number would change because of the decentralization reform.

(c) *Wealth inequality*

Decentralization of natural resources might conceivably either exacerbate or alleviate local wealth inequality. Some authors have argued that decentralization exacerbates wealth differences at the

local level (Bardhan & Mookherjee, 2000; Harris, Stokke, & Törnquist, 2005; Platteau, 2004; Hayward, 2003). Inequality is anticipated to increase if local political leaders are able to capture control of forest resources, the resources are quite scarce, and there are readily available markets to sell forest products. On the other hand, decentralization has the potential to decrease inequality if resources are less scarce, there is upward or downward pressure to allow the poor to supplement their incomes with revenues generated from forest resources, and if forests are isolated from markets. As in the case of investment and rule-making, we expect that decentralization's effect on wealth inequality will be mediated by the interaction between reforms and existing institutions, particularly those that facilitate accountability of forest management to poor resource users, as well as the type of income-generating activities available to resource users.

Reforms in Uganda did little to create upward accountability. The former forest service was all but abandoned, so there was little oversight of local political elites. There were readily available markets to sell forest resources and realize gains from capture. This gave local elites the opportunity to gain from decentralization at the expense of other users. Because the forests in Uganda are relatively scarce resources, under increasing pressure as population growth continues at a high rate, the poor had fewer opportunities to realize benefits from the forests that were not captured (Jagger, 2009). Because of these conditions, we expect wealth inequality to increase following decentralization.

In Bolivia, on the other hand, we anticipate that wealth inequality will decrease following decentralization. First, the Forestry Superintendence and Ministry of Sustainable Development and Planning provide checks against municipal corruption. Second, the forests are more isolated from markets. These two factors should make it more difficult for municipal-level elites to capture the forest resources. Finally, forest resources are relatively less scarce in Bolivia. Because the decentralization reforms allowed indigenous and other user groups rights to harvest from the forest, local officials and other elites should have more difficulty in capturing the resources, and since resources were abundant, these new harvesters should have the potential to supplement their pre-decentralization incomes with subsistence forest resources.

In Mexico there is some downward accountability, as forest governance is organized at multiple levels and reforms have often originated at the lowest levels of governance. The federated governance system also allows for a degree of upward accountability. However, forest resources are scarcer and are easily accessible to markets, increasing the likelihood that poor users are excluded from forest benefits. Still, increased accountability may be enough to overcome these effects so we hypothesize that wealth inequality will decrease.

We have less confidence in our expectations of the Kenyan reforms. The law was passed in 2005, stipulating the creation of CFAs, but their role remains to be seen. Our data analysis here can be construed as an analysis of the effects of the reform, but the reason for these effects remains unclear.

(e) Forest conditions

One of the most often cited justifications for decentralization is to improve forest conditions. Again, we hypothesize that the effects of decentralization on forest conditions will depend on the interaction of reforms with local institutions and incentive structures, including forest scarcity, monitoring and sanctioning activities of user groups, and decentralization policies.

In Bolivia, we expect to see little difference in forest conditions, on average, after decentralization. Compared to the other countries, forest resources are much less scarce; thus, potential deforestation is less likely to have a significant impact on the overall structure of the forest than the other countries. In Uganda, where there is little oversight of the forests, the forest is scarce, and resources are close to markets, we anticipate that forest conditions would decrease rapidly. In Mexico, lower population growth, better oversight, and a more stable recent political history might make it less likely for decentralization to negatively impact forest conditions. In Kenya we remain uncertain.

4. DESCRIPTION OF DATA

To investigate the effects of forest decentralization policies in these four countries we perform a variety of statistical analyses. Data are taken from the International Forestry Resources and Institutions (IFRI) research program. This program is unique in that forest sites for each country have been visited both before and after decentralization reforms. Forest sites are not randomly chosen, but neither are they

selected because of key characteristics of the dependent variables. As such, care should be taken when generalizing these results; specifically, the findings only hold for similar forests in each country (Coleman, 2009).

At each site, an interdisciplinary team of social and natural scientists gather data both on the biological conditions of the forests as well as data on forest communities and user groups. The unit of analysis for this paper is the user group. That is, during each IFRI visit researchers inventory every forest user group in the forest and gather data on their behaviors in relation to the forest. For more information on IFRI and the data gathering protocols the reader is referred to Wollenberg et al. (2007). The data analysis strategy is to assess how user group behaviors have changed in years after decentralization. Table 2 gives the distribution of the data gathered from the user groups across countries both before and after decentralization reforms were passed. There are 303 user group entries from the four countries.

[TABLE 2 ABOUT HERE]

(a) *Variable descriptions*

We are interested in four outcomes from these user groups: rulemaking, differences in wealth, the perceived conditions of the forest, and investments in the forest. As discussed previously, decentralization affects each of these indicators. We measure each of these outcome variables as a binary variable. See Appendix A for the exact phrasing of each of the questions used to construct the variables.

Forest investment activities include planting seeds, trees, and bushes. The frequency with which the user group engaged in each activity was assessed. Forest investments are coded to indicate if the user ever engages in forest investment activities (=1) or not (=0). Rulemaking takes the value of 1 if the user group engages in rulemaking and 0 if it does not.

The measure for wealth inequality indicates if there are substantial perceived differences in wealth (=1) or not (=0), as assessed by the IFRI team conducting the research. We measure forest conditions with a user group ranking of their own forest conditions compared to the conditions from ecologically similar forests. Thus forest conditions take the value of 1 if the group assesses the conditions

as equivalent to or in better condition than other forests, and a value of 0 if they assess that the conditions are worse.

While decentralization is a continuous process and is coarsely identified by our treatment of behavior using a before and after time measurement, the years of decentralization in this analysis are based on important dates of legislation that changed forest management responsibilities. For some countries this was much more gradual, as in Mexico. Still we find it useful to assess the effects of the reform from the given reform year from past conditions. For other countries there were distinct events which separate decentralized management from a centralized period, such as the National Forestry and Tree Planting Act in 2003 in Uganda. Note that our data only capture the change in user group activity for the indicated year of reform, for each country, as reported in Table 2. So, for example, we compare user group activities in Uganda before 2003 with their activities after 2003, while we compare user group activities in Bolivia before 1997 with activities after 1997.

In the following sections we also make reference to a number of control variables, including the following: forest size, in hectares; scarcity of forest resources, as measured by the number of user group members per hectare of forest; monitoring and sanctioning, a dichotomous variable indicating if the user group frequently engages in such activities (=1) or not (=0), and; the proportion of subsistence households in the user group, measured as the number of subsistence households as a fraction of the total households in the user group.

(b) Descriptive statistics

Data are collected for every inventoried user group during IFRI visits. Each variable is binary; thus, the estimated means are simply the proportion of user groups that have one of the variables equal to one. In Figure 1, data are presented at times both before and after decentralization for each country and for each variable. In the table of Appendix A we show the statistical tests for a significant difference before and after decentralization. The final row of this table reports a z-test statistic from a comparison of equivalent proportions before and after decentralization for each variable.

[FIGURE 1 ABOUT HERE]

The difference in proportions test show the following trends in years of decentralization as compared to pre-decentralization: significant increases in forest investments in Bolivia, Mexico, and Uganda and a significant decrease in forest investments in Kenya. There was a significant increase in rulemaking in Bolivia, Kenya and Uganda, but not in Mexico. Wealth inequality was significantly exacerbated only in Uganda. Finally, user groups' perceptions of forest conditions did not significantly change in any country. Descriptive statistics for the control variables are found in Table 3.

[TABLE 3 ABOUT HERE]

5. MODEL ESTIMATION

Our primary concern in this analysis is to assess the role of decentralization, holding the control variables constant. In the preceding discussion of descriptive statistics we found some significant changes in the key dependent variables in Table 1; however, there are possible alternative explanations for these changes. Therefore, we include a number of control variables that might provide alternative explanations for the summary statistics we observed in the previous section.

The dependent variables are each binary and thus in our analysis we employ probit models to estimate the effects of decentralization on each outcome variable (see Long, 1997). One complicating factor, however, is that some user groups before decentralization may have significantly different values of the control variables than the user groups inventoried after decentralization. To investigate this possibility we also employ propensity score matching—nearest neighbor and nearly exact matching. In the nearest neighbor matching, user groups under decentralization are matched with the five most similar user groups (in terms of the control variables) prior to decentralization. Differences in the outcomes are then tested by comparing the outcome variables in these similar user groups. In nearly exact matching, user groups are matched with user groups from the same forest prior to decentralization, if possible, and where there are no user groups prior to decentralization from that forest, they are matched to the five most similar user groups outside of the forest. Again, outcomes are compared and tested to assess if there has been a significant difference.⁶

We report the estimated Average Treatment Effect on the Treated (ATT) for both matching estimators. This gives an estimate of the effects of decentralization given that decentralization occurred for a given user group (Morgan & Harding, 2006). We prefer the ATT estimates from nearly exact matching because differences in forest characteristics might provide a powerful alternative explanation of the decentralization effects. Without nearly exact matching, these forest specific differences are not accounted for in the estimation of the treatment effects; instead estimates of the treatment effects rely solely on differences in user group characteristics of the measured variables for identification. In the probit models the marginal effects of decentralization are estimated as well. We initially used multilevel probit models to estimate forest specific effects, but these estimates were very similar to using standard errors clustered at the forest level. In addition, all the probit models suffer from the fact that user groups prior to decentralization have different distributions of the control variables. Still, probit marginal effects (with cluster-robust standard errors) are reported along with both matching estimators as a reference.

The probit models are estimated via maximum likelihood, while the matching estimators use the algorithm of Abadie et al. (2004) for use in Stata. In order to match post-decentralization user groups with pre-decentralization user groups, we evaluate the similarity of these groups based on the control variables. “Similarity” in this algorithm is defined by a vector norm, $\|\mathbf{x}\| = (\mathbf{x}'\mathbf{V}\mathbf{x})^{\frac{1}{2}}$, where \mathbf{x} is the vector of control variables and \mathbf{V} is a positive definite weighting matrix used to correct for the different scales of the control variables. This vector norm is calculated for all user groups; vector norms for user groups in the post-decentralization era are then compared to all user groups in the pre-decentralization era, and the closest five are chosen to match with the post-decentralization group. Outcomes from the pre-decentralization matches are then weighted by 1/5 and compared to the outcome from the post-decentralization group.

(a) *Forest investments*

The frequency of forest investments is a binary indicator of the frequency of investment activities including planting seeds, trees, and bushes as described in the previous section. Estimates for each

country from the probit model, nearest neighbor matching estimator, and nearly exact matching are reported in top panel of Table 4 under the heading Forest Investments. (The full estimates from the probit model are found in Appendix B.)

[TABLE 4 ABOUT HERE]

For these sections on interpreting the effects of decentralization we concentrate and interpret the results from the nearly exact matching procedure, because we view it as the most relevant for this application. This analysis suggests that after decentralization the proportion of user groups making forest improvements in Bolivia increased by about 0.48 ($p < 0.01$), holding the other variables constant. In Uganda, decentralization years slightly increased in the proportion of forest improvements by 0.10 ($p < 0.10$), while these activities seem unaffected in Mexico. In Kenya, decentralization years are associated with a much lower proportion of user groups making forest investments; the proportion fell by 0.43 ($p < 0.01$).

(b) *Rulemaking*

The variable for rulemaking is a binary variable indicating if the user group makes rules (=1) or not (=0). Estimates for each country from the probit model, nearest neighbor matching estimator, and nearly exact matching are reported in the second panel of Table 4 under the heading Rulemaking. (The full estimates from the probit model are found in Appendix C.) It appears that years of decentralization are associated with an increase in rulemaking activities in all the countries, although the increase is not statistically significant in three of the four countries. Only in Uganda did the proportion of user groups making rules increase in decentralization years, by 0.22 ($p < 0.01$), holding the other variables constant.

(c) *Wealth Inequality*

Wealth inequality is a dichotomous variable and we similarly model the outcome with a probit model. Note that a positive outcome here means there is a more unequal distribution of wealth in the user group. The third panel of Table 4, under the heading Wealth Inequality, reports the marginal effects of decentralization in the probit model as well as the nearest neighbor matching estimator and the nearly exact matching estimator.

In Bolivia and Mexico it appears that years of decentralization are associated with a decrease in the proportion of user groups with an uneven wealth distribution. In Bolivia, this decrease is slight and statistically insignificant, while in Mexico, the years of decentralization are associated with a decreased proportion of over 0.3 ($p < 0.10$). In the African countries we find that wealth inequalities are exacerbated by decentralization. While wealth distribution did not change very much in Kenya (and was not statistically significant), the proportion of user groups with an unequal wealth distribution in Uganda significantly increased by 0.264 ($p < 0.01$).

(d) *Forest conditions*

Forest conditions are also binary, indicating a forest with conditions (as ranked by user groups) as being in worse than similar forests (=0) or the same or better than similar forests in the region (=1). As in the previous sections, probit marginal effects and the matching estimators are reported in the last panel of Table 4 under the heading Forest Conditions.

There are mixed results as to the effects of decentralization on forest conditions—some countries appear to be impacted negatively while others are impacted positively. However, in three of the four countries the effects are substantively very small. Only in Mexico are decentralization years strongly associated with forest conditions, and there the results appear to be quite comforting. Mexican user groups are more likely to rank the forest as being in average or above average conditions; in years after decentralization the proportion of user groups with a good ranking of the forest rose by nearly 0.8 ($p < 0.01$), after accounting for the other factors. The magnitude of this effect is very large. This effect may be the result of a rising environmental consciousness promoted by NGOs, academics, and government agencies.

Surprisingly, in Uganda forest conditions appear only marginally negatively affected by decentralization. There is substantial literature, however, that shows that forest conditions declined rapidly in Uganda after decentralization (Banana et al., 2007; Coleman, Kershaw, & Fischer, 2009; Jagger, 2009; Namubiru, 2008). There may be two reasons for this. First, our variable here measures user groups' perceptions of forest conditions and thus may not reflect ecological conditions. In other words,

even if the forest is in poor condition, user groups may consider this to be preferable to the prior state of affairs when they could not use the forest, or may give more value to forest products available in ecologically degraded forests, such as fodder or non-timber forest products, than to forest products available in healthy forests, such as timber, harvesting of which requires levels of capital investment beyond the capability of most local users (Jagger, 2009). Second, our variable asks user groups to compare their forests to other forests in similar ecologies in the region. If all of the forests in the region are in poor shape then their forests might not be ranked as low as otherwise might be the case.

6. DISCUSSION

The results from the previous section will now be compared to our theoretical expectations as outlined in Table 1. In that table we posited that forest investments would increase in Bolivia, Kenya, Mexico, and not be effected in Uganda. In our empirical analysis, however, we found that decentralization was associated with increases in forest investments in Uganda and Mexico, and slightly increased in Bolivia. We did not anticipate that forest investments would fall so dramatically in Kenya. Our sense is that the reforms are still quite new; Kenya was highly centralized before the reforms and local user groups may take some time adapting to the new institutional environment.

We expected rulemaking to increase in every country except Mexico where we anticipated there would be no effect. Our results validated this expectation, but the only significant changes in rulemaking occurred in Uganda. Perhaps the macro-level instability in Uganda was so potent that user groups had strong incentives to make rules to compensate, while the other countries did not experience a comparable event.

We expected wealth inequality to increase in Uganda, were uncertain about Kenya, and we expected wealth inequality to be lessened in Mexico and Bolivia. In Mexico, especially, there appears to be a strong correlation with years of decentralization and a more equal distribution of wealth. In Uganda, as anticipated, wealth inequality increased significantly in the post-decentralization years.

We were less sure about the effects on forest conditions in the four countries. We anticipated that the effects on forest conditions in Mexico would be positive and they were positive and very large. In the

remaining countries, however, it does not appear that decentralization policies had a major effect on the user groups' perception of forest conditions relative to similar forests in the region.

7. CONCLUSION

In this paper we have argued that the expectations of policy analysts and researchers on the effects of natural resource decentralization need to be adjusted to fit the context both of (a) the types of decentralization reforms being implemented and (b) the context in the country within which they are implemented. We illustrated how a researcher might go about generating hypotheses based upon these factors and how our expectations changed based upon differences in these characteristics. We then analyzed decentralization policies in four different countries to test our hypotheses from the previous section.

We believe a number of important lessons can be learned from this research. First, researchers and policymakers need to think carefully about the full range of possible outcomes from decentralization policies and how the context of decentralization reforms can have major implications for decentralization impacts. Decentralization should not be thought of as a monolithic idea—that is, decentralization means different things to different people. Researchers and policymakers should explicitly define what they mean by decentralization when discussing any potential impacts.

Second, despite our admonition that decentralization effects are context specific, we realize there is little precise theory indicating how decentralization will vary by context. Analysts are a long way off from making point predictions about how decentralization, even if properly and carefully defined, will affect outcomes. This analysis indicates, however, that the stability of reforms, scarcity of forest products, size of the units affected, and dependence of user groups on the resource, will affect a broad range of decentralization goals. In addition, these effects might be anticipated to be different depending on the specific details of the decentralization reform.

Third, most analysis of forest decentralization has focused on the change in rule structure at the macro level (see Agrawal & Ribot, 1999). Our hypotheses emphasize variables that impact the behavior of local users, rather than the macro political variables favored by many analysts who take a top-down

approach. More attention needs to be paid to how local institutions and user behaviors change and adapt to broader policy reforms. Also, we echo the plea by Andersson & Gibson (2007), to research the environmental outcomes of decentralization policies. While we believe we have made a significant advance in this paper by examining both institutional outcomes (forest investments and rulemaking) as well as program impacts (wealth inequality and forest conditions) as assessed by user groups, we realize that more research needs to be done to rigorously examine more objective measures of environmental impacts.⁷

Fourth, while we acknowledge and support the development of theory in regards to decentralization impacts, this analysis adds to the limited existing empirical literature. In some cases, our theories of the effects of decentralization were wrong, indicating a need to revisit theoretical expectations. Only by combining rigorous, contextualized theory with empirical analysis can our understanding of decentralization be advanced.

8. REFEEERENCES

- Abadie, A., Herr, J.L., Imbens, G.W., & Drukker, D.M. (2004). Implementing matching estimators for average treatment effects in Stata. *The Stata Journal* 4: 290-311.
- Acheson, J.M. (1988). *The lobster gangs of Maine*. Lebanon, NH: University Press of New England.
- Agrawal, A.A., Chhatre, A., & Hardin, R. (2008). Changing governance of the world's forests. *Science* 320: 1460-1462.
- Agrawal, A.A., & Ribot, J.C. (1999). Accountability in decentralization: a framework with south Asian and west African cases. *The Journal of Developing Areas* 33: 473-502.
- Andersson, K.P. (2002). *Can decentralization save Bolivia's forests? An institutional analysis of municipal forest governance*. Ph.D. diss, Indiana University.
- Andersson, K.P., & Gibson, C.C. (2007). Decentralized governance and environmental change: Local institutional moderation of deforestation in Bolivia. *Journal of Policy Analysis and Management* 26: 99-123.

- Andersson, K.P., Gibson, C.C., & Lehoucq, F. (2004). The politics of decentralized governance of natural resources. *PS: Political Science and Politics* 37: 241-248.
- Andersson, K.P., Bauer, J., Jagger, P., Luckert, M., Meinzen-Dick, R., Mwangi, E., & Ostrom, E. (2008). *Unpacking decentralization*. Paper presented at the SANREM CRSP Annual Meeting, Los Baños, Philippines, May 26-28, 2008.
- Andersson, K.P., & Pacheco, D. (2004). The historical origins of forestry policy in bolivia: lessons for community forestry. *Policy Matters* 13: 40-49.
- Banana, A.Y., Vogt, N.D., Gombya-Ssembajjwe, W., & Bahati, J. (2007). Decentralized governance and ecological health: why local institutions fail to moderate deforestation in Mpigi district of Uganda. *Scientific Research and Essay* 2: 434-445.
- Bardhan, P.K., & Mookherjee, D. (2000). Capture and governance at local and national levels. *American Economic Review* 90: 135-39.
- Berkes, F. (1999). *Sacred ecology: Traditional ecological knowledge and resource management*. Philadelphia: Taylor & Francis.
- Boone, C. (2007). Property and constitutional order: Land tenure reform and the future of the African state. *African Affairs* 106: 557-586.
- Bossuyt, J., Hauck, V., & Keijzer, N. (2007). *Supporting decentralisation and local governance in third countries*. Tools and Reference Series Reference Document 2, Brussels: European Commission.
- Bray, D.B., Antinori, C., & Torres-Rojo, J.M. (2006). The Mexican model of community forest management: The role of agrarian policy, forest policy and entrepreneurial organization. *Forest Policy and Economics* 8: 470-484.
- Cheema, G.S., & Rondinelli, D.A. eds. (1983). *Decentralization and development: Policy implementation in developing countries*. Beverly Hills, CA: Sage Publications.
- Coleman, E.A. (2009). Institutional factors affecting biophysical outcomes in forest management. *Journal of Policy Analysis and Management* 28: 122-146.

- Coleman, E.A., Kershaw, J., & Fischer, B. (2009). *Using Stocking Guides to Take Stock of Forest Institutions*. Workshop in Political Theory and Policy Analysis Working Paper, Bloomington, IN, Indiana University.
- Coleman, E.A., & Steed, B.C. (2009). Monitoring and sanctioning in the commons: An application to forestry. *Ecological Economics* 68: 2106-2113.
- Cohen, J.M., & Peterson, S.B. (1999). *Administrative decentralization: Strategies for developing countries*. West Hartford, CT: Kumarian Press.
- Cohen, J.M., & Peterson, S.B. (1996). *Methodological issues in the analysis of decentralization*. HIID Development Discussion Paper No. 555, Cambridge, MA, Harvard Institute for International Development.
- Corbridge, S., & Jewitt, S. (1997). From forest struggles to forest citizens? Joint Forest Management in the unquiet woods of India's Jharkhand. *Environment and Planning A* 29: 2145-2164.
- de Janvry, A., Dutilly, C.E., Munoz-Pina, C., & Sadoulet, E. (2001). Liberal reforms and community responses in Mexico. In Masahiko Aoki and Yujiro Hayami, eds, *Communities and markets in economic development*. Oxford: Oxford University Press.
- Diamond, J.M. (1966). Zoological classification system of a primitive people. *Science* 151: 1102-1104.
- Dininio, P. (2000). *USAID's experience in decentralization and democratic local governance*. Washington, DC: U.S. Agency for International Development, Center for Democracy and Governance, Bureau for Global Programs, Field Support, and Research.
http://www.usaid.gov/our_work/democracy_and_governance/publications/pdfs/pnach302.pdf
(accessed July 8, 2009).
- Feeny, D., Berkes, F., McCay, B.J., & Acheson, J.M. (1990). The tragedy of the commons: Twenty-two years later. *Human Ecology* 18: 1-19.
- Gadgil, M., & Berkes, F. (1991). Traditional Resource Management Systems. *Resource Management and Optimization* 8: 127-141.

- Gadgil, M., Berkes, F., & Folke, C. (1993). Indigenous Knowledge for Biodiversity Conservation. *Ambio* 22: 151-156.
- Gordillo, G., de Janvry, A., & Sadoulet, E. (1998). Between Political Control and Efficiency Gains: The Evolution of Agrarian Property Rights in Mexico. *CEPAL Review* 66: 151-169.
- Harris, J., Stokke, J.K., & Törnquist, O. eds. (2005). *Politicizing democracy: The new local politics of democratization*. New York: Palgrave Macmillan.
- Hayes, T.M. (2006). Parks, people, and forest protection: An institutional assessment of the effectiveness of protected areas. *World Development* 34: 2064-2075.
- Hayward, C.R. (2003). The difference states make: Democracy, identity, and the American city. *American Political Science Review* 97: 501-14.
- Jagger, P. *Renegotiating livelihoods after Uganda's forest sector reform*. Ph.D. diss, Indiana University.
- Klooster, D. (2003). Campesinos and Mexican forest policy during the twentieth century. *Latin American Research Review* 38: 94-126.
- Larson, A. M. (2003). Decentralisation and forest management in latin america: towards a working model. *Public Administration and Development* 23(3): 211-26.
- Larson, A.M., & Ribot, J.C. (2007). The poverty of forestry policy: double standards on an uneven playing field. *Sustainability Science* 2: 189-204.
- Long, J.S. (1997). *Regression models for categorical and limited dependent variables*. Thousand Oaks, CA: Sage Publications.
- Morgan, S.L., & Harding, D.J. (2006). Matching estimators of causal effects: Prospects and pitfalls in theory and practice. *Sociological Methods & Research* 35: 35-60.
- Namubiru, E.L. (2008). *Coping with top-down institutional changes in forestry*. Ph.D. diss, Indiana University.
- Netting, R.M. (1981). *Balancing on an Alp*. Cambridge: Cambridge University Press.
- Omondi, J., & Omosa, E. (2002). Capturing Opportunities for change in Kenya—Preparing stakeholders for the new Forest Act. *Forests, Trees, and People* 46: 29-32.

- Ongugo, P.O., Mogoi, J.N., Obonyo, E., & Oeba, V. (2008). *The effect of internal human conflicts on forest conservation and sustainable development in Kenya*. Paper presented in the IASC Conference, Cheltenham, England, July 11-19.
- Ongugo, P.O., & Njuguna, J.W. (2004). *Effects of decentralization policies on forest management: experience from seven forests in Kenya*. Paper presented at the Tenth Conference of the International Association for the Study of Common Property, Oaxaca, Mexico, August 9-13.
- Ostrom, E. *Governing the commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press.
- Ostrom, E., Gardner, R., & Walker, J.M. (1994). *Rules, games, and common-pool resources*. Ann Arbor: University of Michigan Press.
- Ostrom, E., Schroeder, L.D., & Wynne, S.G. (1993). *Institutional incentives and sustainable development: infrastructure policies in perspective*. Boulder, CO: Westview Press.
- Pacheco, D. (2007). *An institutional analysis of decentralization and indigenous timber management in common-property forests of Bolivia's lowlands*. Ph.D. diss, Indiana University.
- Platteau, J.-P. (2004). Monitoring elite capture in community-driven development. *Development and Change* 35: 223-46.
- Poole, J.H., & Leakey, R.E. (1996). Kenya. In Ernst Lutz and Julian Caldecott, eds., *Decentralization and Biodiversity Conservation*. Washington, DC: World Bank Publications.
- Pressman, J.L., & Wildavsky, A. (1978). *Implementation: How great expectations in Washington are dashed in Oakland; or, why it's amazing that federal programs work at all, this being a saga of the economic development administration as told by two sympathetic observers who seek to build morals on a foundation of ruined hopes*. Berkeley: University of California Press.
- Ribot, J.C. *Building local democracy through natural resource interventions: An environmentalist's responsibility*. Washington, DC: World Resources Institute Policy Brief.
- Ribot, J.C., Agrawal, A.A., & Larson, A.M. (2006). Recentralizing while decentralizing: How national governments reappropriate forest resources. *World Development* 34: 1864-1886;

- Ribot, J.C., & Larson, A.M. eds. (2005). *Democratic decentralization through a natural resource lens*. New York: Routledge.
- Sabatier, P.A. (1986). Top-down and bottom-up approaches to implementation research: a critical analysis and suggested synthesis. *Journal of Public Policy* 6: 21-48.
- Treisman, D. (2007). *The architecture of government: Rethinking political decentralization*. New York: Cambridge University Press.
- Turyahabwe, N., & Banana, A.Y. (2008). An overview of history and development of forest policy and legislation in Uganda. *International Forestry Review* 10: 641-656.
- von Hayek, F.A. (1939). The economic conditions of interstate federalism. *New Commonwealth Quarterly* 131: 49.
- von Hayek, F.A. (1945). The use of knowledge in society. *American Economic Review* 35: 519-530.
- Wollenberg, E., Merino, L., Agrawal, A., & Ostrom, E. (2007). Fourteen years of monitoring community-managed forests: learning from IFRI's experience. *International Forestry Review* 9(2): 670-684.
- World Bank. (2009). *Community driven development*. <http://go.worldbank.org/24K8IHVVS0> (accessed July 8, 2009).

TABLES

Table 1. *Summary of hypothesized effects of decentralization*

Country	Forest Investments	Rulemaking	Wealth Inequality	Forest Conditions
<i>Bolivia</i>	+	+	-	<i>No effect</i>
<i>Kenya</i>	+	+	<i>Uncertain</i>	<i>Uncertain</i>
<i>Mexico</i>	+	<i>No effect</i>	-	+
<i>Uganda</i>	<i>No effect</i>	+	+	-

Notes: Hypothesized relationships in cells: + positive effect; - negative effect; *Uncertain*, uncertain effect; *No effect*, no hypothesized relationship

Table 2. *Distributions of user groups by country before and after decentralization*

Country	Year of Decentralization	Pre Decentralization	Post Decentralization	Total
<i>Bolivia</i>	1997	42	11	53
<i>Kenya</i>	2005	57	14	71
<i>Mexico</i>	2003	21	19	40
<i>Uganda</i>	2003	102	42	144
Total		222	86	308

Table 3. *Descriptive statistics for control variables*

Variable	Mean	Standard Deviation	N
<i>Bolivia</i>			
ln(Scarcity)	-5.707	1.477	44
Monitoring and Sanctioning	0.358	0.484	53
Subsistence Users	0.729	0.415	53
ln(Forest Size)	8.458	1.323	44
<i>Kenya</i>			
ln(Scarcity)	-2.181	2.556	69
Monitoring and Sanctioning	0.338	0.476	71
Subsistence Users	0.842	0.306	71
ln(Forest Size)	6.677	2.198	69
<i>Mexico</i>			
ln(Scarcity)	-0.660	2.404	40
Monitoring and Sanctioning	0.650	0.483	40
Subsistence Users	0.516	0.467	40
ln(Forest Size)	5.177	2.180	40
<i>Uganda</i>			
ln(Scarcity)	-2.413	1.788	138
Monitoring and Sanctioning	0.118	0.324	144
Subsistence Users	0.880	0.285	144
ln(Forest Size)	6.355	1.572	138

Table 4. *Decentralization effects on outcome variables from various models*

	Bolivia	Kenya	Mexico	Uganda
Forest Investments				
Probit Marginal Effect	0.493*** (0.12)	Not Identified	0.047 (0.45)	0.147** (0.07)
Nearest Neighbor Matching (m=5) ATT	0.479*** (0.16)	-0.431*** (0.14)	0.195 (0.15)	0.103* (0.06)
Nearly Exact Matching ATT	0.121 (0.11)	-0.264** (0.13)	0.249* (0.13)	0.117** (0.06)
Rulemaking				
Probit Marginal Effect	0.393* (0.22)	0.096 (0.25)	0.095 (0.24)	0.029 (0.14)
Nearest Neighbor Matching (m=5) ATT	0.284 (0.18)	0.211 (0.38)	0.162 (0.16)	0.219*** (0.07)
Nearly Exact Matching ATT	0.293 (0.18)	0.172 (0.31)	0.210 (0.14)	0.254*** (0.07)
Wealth Inequality				
Probit Marginal Effect	-0.098 (0.18)	0.058 (0.10)	-0.311 (0.37)	0.139 (0.11)
Nearest Neighbor Matching (m=5) ATT	-0.004 (0.21)	0.038 (0.16)	-0.119 (0.20)	-0.044 (0.10)
Nearly Exact Matching ATT	-0.069 (0.23)	0.149 (0.16)	-0.304* (0.17)	0.264*** (0.10)
Forest Conditions				
Probit Marginal Effect	0.010 (0.09)	-0.085 (0.11)	0.790*** (0.08)	-0.003 (0.14)
Nearest Neighbor Matching (m=5) ATT	-0.034 (0.17)	-0.053 (0.12)	1.017*** (0.21)	0.106 (0.10)
Nearly Exact Matching ATT	0.051 (0.20)	-0.018 (0.09)	0.791*** (0.12)	-0.095 (0.11)

Notes: Two tailed hypothesis tests: ***p<0.01, **p<0.05, *p<0.10

FIGURES

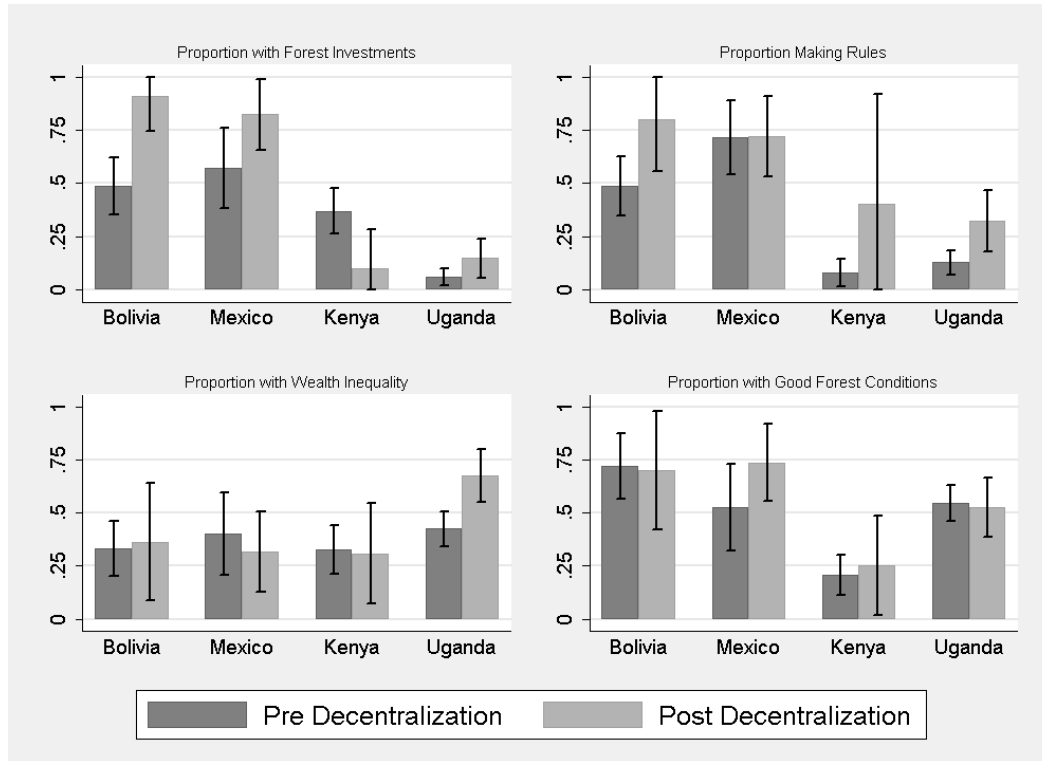


Figure 1. *Distribution of dependent variables before and after decentralization by country. Mean levels of user group behavior both before and after decentralization and 90% normal confidence intervals for those means.*

APPENDIX A. DESCRIPTIVE STATISTICS FOR DEPENDENT VARIABLES				
	Bolivia	Kenya	Mexico	Uganda
<i>Forest Investments</i>				
Pre Prop	0.49	0.37	0.57	0.06
Pre N	39	57	21	101
Post Prop	0.91	0.10	0.82	0.15
Post N	11	10	17	41
z-Stat	2.50***	-1.67*	1.66*	1.69*
<i>Rulemaking</i>				
Pre Prop	0.49	0.08	0.71	0.13
Pre N	37	50	21	95
Post Prop	0.80	0.40	0.72	0.32
Post N	10	5	18	31
z-Stat	1.77*	2.19**	0.05	2.50***
<i>Wealth Inequality</i>				
Pre Prop	0.33	0.33	0.40	0.42
Pre N	39	49	20	99
Post Prop	0.36	0.31	0.32	0.68
Post N	11	13	19	40
z-Stat	0.19	-0.13	-0.55	2.68***
<i>Forest Conditions</i>				
Pre Prop	0.72	0.21	0.53	0.55
Pre N	25	53	19	95
Post Prop	0.70	0.25	0.74	0.53
Post N	10	12	19	38
z-Stat	-0.12	0.32	1.35	-0.22

Notes: Pre Prop: Proportion of user groups prior to decentralization with a dependent variable coded as one. Pre N: Sample size of user groups prior to decentralization. Post Prop: Proportion of user groups after decentralization with a dependent variable coded as one. Post N: Sample size of user groups after decentralization. z-Stat: z statistic from an equivalence of proportions test. Two tailed hypothesis tests: ***p<0.01, **p<0.05, *p<0.10

APPENDIX B. IFRI QUESTION FOR ANALYZED VARIABLES

(a) *Making Rules*

Are there some individuals in this user group responsible for making rules about the forest? (Yes/No)

(b) *Wealth Difference*

Given the local definition of wealth, is there a great difference in wealth among households (as locally defined) in the user group? (Yes/No)

(c) *Forest Conditions*

How do most individuals in the user group rank the condition of this forest? (1—Sparse, 2—Somewhat sparse, 3—About normal for this ecological zone, 4—Somewhat abundant, 5—Very abundant)

NOTE: This variable is recoded such that a ranking above 3 is equal to 1 and below three is equal to 0.

(d) *Forest Investments*

Have individuals in this user group undertaken any of the following management or regeneration activities, and if so, how frequently?

Planted seedlings? (0—Never, 1—Done once a year, 2—Done every several years, 3—done about every five years, 4—Done about every ten years, 5—Rarely done)

Planted trees? (0—Never, 1—Done once a year, 2—Done every several years, 3—done about every five years, 4—Done about every ten years, 5—Rarely done)

Planted Bushes? (0—Never, 1—Done once a year, 2—Done every several years, 3—done about every five years, 4—Done about every ten years, 5—Rarely done)

NOTE: This variable is coded as 0 if Never is answered for each question and 1 if there is a positive amount answered for any question.

APPENDIX C. PROBIT MARGINAL EFFECTS FOR FOREST IMPROVEMENTS

	Bolivia	Kenya	Mexico	Uganda
Decentralization (d)	0.493*** (0.12)	Not Identified	0.047 (0.45)	0.147** (0.07)
ln(Households per HA)	0.287*** (0.08)	-0.048 (0.05)	0.056 (0.13)	-0.029 (0.02)
Monitor & Sanction (d)	-0.096 (0.33)	-0.195* (0.11)	0.231 (0.16)	0.013 (0.11)
Proportion Subsistence Users	0.049 (0.25)	-0.258 (0.21)	-0.194 (0.22)	-0.160** (0.08)
ln(Forest Size)	0.654*** (0.17)	-0.038 (0.05)	0.165 (0.12)	-0.001 (0.02)
Log-Likelihood	-9.59	-35.44	-16.88	-34.50
AIC	31.17	80.88	45.75	81.00
BIC	41.60	91.09	55.58	98.48
N	42	57	38	136

(d) for discrete change of dummy variable from 0 to 1, Two tailed hypothesis tests: * p<0.10**, p<0.05***, p<0.01

APPENDIX D. PROBIT MARGINAL EFFECTS FOR RULEMAKING

	Bolivia	Kenya	Mexico	Uganda
<i>Decentralization (d)</i>	0.393* (0.22)	0.096 (0.25)	0.095 (0.24)	0.029 (0.14)
<i>ln(Households per HA)</i>	0.393*** (0.14)	0.013 (0.02)	0.086** (0.04)	-0.001 (0.01)
<i>Monitor & Sanction (d)</i>	0.248 (0.22)	0.253* (0.15)	0.461*** (0.16)	0.375 (0.90)
<i>Proportion Subsistence Users</i>	0.144 (0.27)	-0.112 (0.09)	-0.505*** (0.18)	0.181 (0.84)
<i>ln(Forest Size)</i>	0.543*** (0.19)	0.005 (0.02)	0.018 (0.06)	-0.001 (0.01)
<i>Log-Likelihood</i>	-13.14	-14.00	-14.64	-31.35
<i>AIC</i>	38.28	40.00	41.29	74.71
<i>BIC</i>	48.42	51.94	51.27	91.43
<i>N</i>	40	54	39	120

(d) for discrete change of dummy variable from 0 to 1, Two tailed hypothesis tests: * p<0.10**, p<0.05***, p<0.01

APPENDIX E. PROBIT MARGINAL EFFECTS FOR WEALTH INEQUALITY

	Bolivia	Kenya	Mexico	Uganda
Decentralization (d)	-0.098 (0.18)	0.058 (0.10)	-0.311 (0.37)	0.139 (0.11)
ln(Households per HA)	0.095* (0.05)	0.005 (0.05)	0.266*** (0.09)	0.066 (0.04)
Monitor & Sanction (d)	0.113 (0.21)	-0.053 (0.09)	0.240 (0.17)	0.314 (0.20)
Proportion Subsistence Users	-0.114 (0.26)	-0.071 (0.17)	0.562** (0.24)	0.073 (0.17)
ln(Forest Size)	0.021 (0.09)	0.063* (0.04)	0.320*** (0.12)	0.025 (0.05)
Log-Likelihood	-23.88	-36.68	-18.82	-86.04
AIC	59.76	85.37	49.63	184.09
BIC	70.05	98.03	59.61	201.43
N	41	61	39	133

(d) for discrete change of dummy variable from 0 to 1, Two tailed hypothesis tests: * p<0.10**, p<0.05***, p<0.01

APPENDIX F. PROBIT MARGINAL EFFECTS FOR FOREST CONDITIONS

	Bolivia	Kenya	Mexico	Uganda
<i>Decentralization (d)</i>	0.010 (0.09)	-0.085 (0.11)	0.790*** (0.08)	-0.003 (0.14)
<i>ln(Households per HA)</i>	-0.081 (0.09)	-0.075** (0.03)	0.154 (0.14)	-0.040 (0.05)
<i>Monitor & Sanction (d)</i>	0.005 (0.07)	0.182 (0.13)	-0.693*** (0.06)	0.202 (0.13)
<i>Proportion Subsistence Users</i>	-0.770** (0.30)	-0.011 (0.14)	-0.288* (0.17)	-0.128 (0.13)
<i>ln(Forest Size)</i>	0.060 (0.07)	-0.098* (0.05)	0.092 (0.13)	-0.006 (0.05)
<i>Log-Likelihood</i>	-13.46	-27.37	-15.65	-84.06
<i>AIC</i>	38.92	66.74	43.30	180.12
<i>BIC</i>	47.71	79.69	53.13	197.18
<i>N</i>	32	64	38	127

(d) for discrete change of dummy variable from 0 to 1, Two tailed hypothesis tests: * p<0.10**, p<0.05***, p<0.01

NOTES

¹ See also Larson (2003).

² For more information on the process of the creation of ejidos and their subsequent reform, see Bray, Antinori, & Torres-Rojo (2006).

³ The Ugandan Wildlife Authority (UWA) controls another 15% of forested areas as National Parks and Game Preserves. Its main source of revenue is from entrance fees, and it engages in limited revenue sharing with local communities. No commercial harvesting is permitted in UWA lands.

⁴ Although we do not discount the importance of these aspirations in decentralization in some countries, this has not been the primary driving force behind decentralization in many countries. In fact, common forms of decentralization, such as administrative deconcentration and delegation of authority to parastatal, non-governmental, or private authorities have little potential to increase democratic control. See Cheema & Rondinelli (1983) and Cohen & Peterson (1999).

⁵ See von Hayek (1939). Von Hayek (1945) later argued that local actors possess unique knowledge of “the particular circumstances of time and place,” which was essential for economic decision-making (p.521). This argument was later extended by Ostrom, Schroeder, & Wynne (1993). Those authors argue that the widespread failure of development projects was due at least in part to the failure of central planners to pursue and incorporate local knowledge. Many authors have found local knowledge to be particularly deep and important in natural systems. See, for example, Berkes (1999), Diamond (1966), Gadgil & Berkes (1991), and Gadgil, Berkes, & Folke (1993). In addition, it is well documented that many traditional resource management schemes have successfully conserved natural resources over long time. Among the many citations, see Netting (1981), Acheson (1988), Feeny, Berkes, McCay, & Acheson (1990), Ostrom (1990), and Ostrom, Gardner, & Walker (1994).

⁶ For this estimation we used the software NNMATCH. See, Abadie et al. (2004). There are a variety of matching estimators in the literature, but there is little guidance as to which matching procedure “works best.” For a discussion, see Morgan & Harding (2006). We favor the nearly exact matching in this application because it balances the need to compare user groups that are the most similar in geography to those that are similar on the control variable characteristics.

⁷ On the other hand, user group perceptions of decentralization impacts may be just as interesting as more objective measures of the impacts.