

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

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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.

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Abstract

In this paper we assess the institutional and environmental impacts of forest decentralization policies 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 in the specific context of each country and then argue that decentralization impacts are moderated by a set of 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.

Keywords:

Decentralization; Community-based Forestry; Institutions; Common-pool Resource

1 Introduction

Forest management decentralization programs have rapidly spread in developing countries in the last twenty years.¹ The effects of decentralized regimes on forest management practices has been the subject of recent research, but the resulting literature is plagued by analytic 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.² Second, decentralization policies interact with numerous other pressures to change governance institutions, forest user behavior, and resulting forest conditions and livelihood outcomes.³ 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.⁴ 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. Most of this literature follows Agrawal and Ribot's framework, which emphasizes the importance of actors, powers, and accountability on the influence of decentralization reforms on governance institutions.⁵ Several authors have concluded that decentralization reforms have reinforced the power of the central state.⁶ 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.

The purpose of this paper is to test hypotheses about behavioral change due to decentralization at the forest user level. Specifically, 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. In Section 3 we outline our theoretical expectations 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 reform histories of Bolivia, Kenya, Mexico, and Uganda.

2.1 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.⁷ The U.S. Agency for International Development indicates that decentralization creates access to political, economic, and social resources that is fairly distributed, elected officials that are accountable to local constituencies, and mechanisms that increase citizen involvement.⁸ A 2007 decentralization reference document assembled by the European Union states that its purpose is not whether but “how best to support processes of decentralization,” citing expectations of improved efficiency in service delivery, participation, and democratization as “push factors” leading to an EU policy that will increasingly seek “to respond positively to countries that define decentralization as a priority.”⁹

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 literature decentralization policies

continue to be adopted. A sound understanding of how local user behavior changes in response to these policies is also needed.

2.2 Bolivia

Andersson and Pacheco divide the history of forestry policy in Bolivia into three segments.¹⁰ 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.¹¹ 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.¹²

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.¹³

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.¹⁴

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.¹⁵ 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.¹⁶

2.3 Kenya

The colonial government of Kenya created a forest department in 1902, but by 1932 had 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.¹⁷

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.¹⁸

Attempts to address the fragmented management structure included the formation of the Wildlife Conservation and Management Department (WCMD) out of the National Parks Board and the Game Department, but this effort was unsuccessful and further centralized control. Neither the new WCMD nor the Forest Department were allowed to retain revenues from their management efforts, resulting in increased corruption and serious decline in forest and wildlife health throughout the country.¹⁹

In 1990, the WCMD became the Kenya Wildlife Service and in 1992, the Kenyan government prepared a national Environment Action Plan that recommended the revision of the Forest Act to allow for community participation and management of forests.²⁰ This resulted in the proposal and eventual passage of the New Forest Act of 2005.

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.²¹ 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.

2.4 Mexico

The process of decentralization in Mexico differs from the processes in Kenya, Bolivia, and Uganda. Mexico's central government invested heavily in creating communally managed forest lands throughout the middle years of the twentieth century. Although this was still a "state-led community forest sector," Mexico's decentralization built on existing modes of center-local collaboration.²²

Decentralization started with the agrarian reforms that created *ejidos* and *comunidades*, beginning with the Mexican constitution of 1917. 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.²³ The process of ejido creation continued throughout the twentieth century, with peaks in 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.²⁴

From 1940 to 1970, forests were largely ignored in public policy, despite the fact that many of the lands being distributed to the ejidos under the agrarian reforms were forested. Conflicting agendas dominated. On the one hand, Mexico tried to develop forest resources as part of import-substitution industrialization through logging concessions on public land, while on

the other hand, bans designed to stop illegal logging also prevented communities from taking advantage of their timber resources. At the same time, the central government trained communities to organize forest enterprises. In the 1970s, the central government increased its efforts to aid community enterprises, and protest movements that had begun in the 1960's slowed or stopped the awarding of concessions to outside actors.

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. 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.²⁵

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.²⁶

Both the 1986 and the 1992 forest laws were written with limited consultation; however, the 1997 law resulted from public dialogue.²⁷ 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.²⁸ 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.

2.5 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 1948.²⁹

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.³⁰

In 1971, a breakdown in law and order led to declining forestry enforcement. Local communities, which had been stripped of rights in the past, did little to protect their forests during this period, leading to extensive agricultural encroachment and forest degradation. During the guerrilla war that followed the fall of the Idi Amin regime in 1979, illegal activities in forest reserves became uncontrollable and forest resources were severely degraded.

Museveni took control at the end of the civil war in 1986 and later introduced decentralization programs in an attempt to consolidate his power.³¹ 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 2003.³² 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.³³

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 Theoretical Expectations for Decentralized Forest Management

Having briefly reviewed the relevant history of forest decentralization in each country, we now turn to contextualized theories of decentralization. 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.³⁴ 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. Decentralization is expected to create a competitive environment for governmental functions, thereby stimulating agencies towards more efficient production.³⁵

There are reasons, however, to be skeptical of potential improvements from decentralizing resource governance to communities.³⁶ 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.³⁷ 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).³⁸

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.³⁹ 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 timber harvesters 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. Anticipated Effects of Decentralization

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

3.1 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.

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 itself was highly unstable 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 they did not increase, holding all else constant, 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. The same degree of uncertainty in property rights did not prevail in these countries. 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.

3.2 Rulemaking

Rulemaking can be seen as another type of investment. 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. Similar to the forest investments discussed in the previous section, we expect rulemaking to be closely linked to the scarcity of forest resources, other site-specific contextual factors, and the decentralization reforms in specific countries, including the user group's perceptions that it has the authority to legitimately make rules. One contextual factor is the willingness of communities to monitor and sanction those that break rules. If communities engage in

monitoring and sanctioning we expect them to be much more likely to make rules as their decisions can be enforced.

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. While rulemaking requires an investment of time, unlike natural investments it generally does not require an investment of capital.

In Kenya, with the creation of CFA and their potential role in the future governance of forests, we would anticipate that user groups would start making rules as a way of inserting themselves into the policymaking process. As noted above, the decentralization reform in Kenya created property rights where previously none had existed—in all likelihood user groups would want to test the meaning and limits of these new rights by establishing new rules.

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.

Decentralization in Bolivia, on the other hand, was quite distinct from previous regimes in the country. Because indigenous harvesting rights were newly recognized these communities

now had an incentive to create rules governing the use of these resources. Thus, we would expect rulemaking activities to increase amongst Bolivian user groups.

3.3 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.⁴⁰ 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.

In Uganda, for example, local forest managers had little upward accountability. The former forest service was all but abandoned, so local political elites had little oversight. 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.⁴¹ Because of these conditions, we would expect wealth inequality to increase following decentralization.

In Bolivia, on the other hand, we anticipate that wealth inequality would decrease. 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 make it more difficult for municipal-level capture of 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 had more difficulty in capturing the resources, and resources were abundant, these new harvesters had the potential to supplement their pre-decentralization incomes with subsistence forest resources.

In Mexico there is a high degree of 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, 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.

3.4 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 scarcity of the forests, monitoring and sanctioning activities of user groups, and the 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 was little oversight of the forests, the forest was scarce, and resources were 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 Data Analysis

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.⁴²

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. 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. 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

4.1 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). 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.

4.2 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.

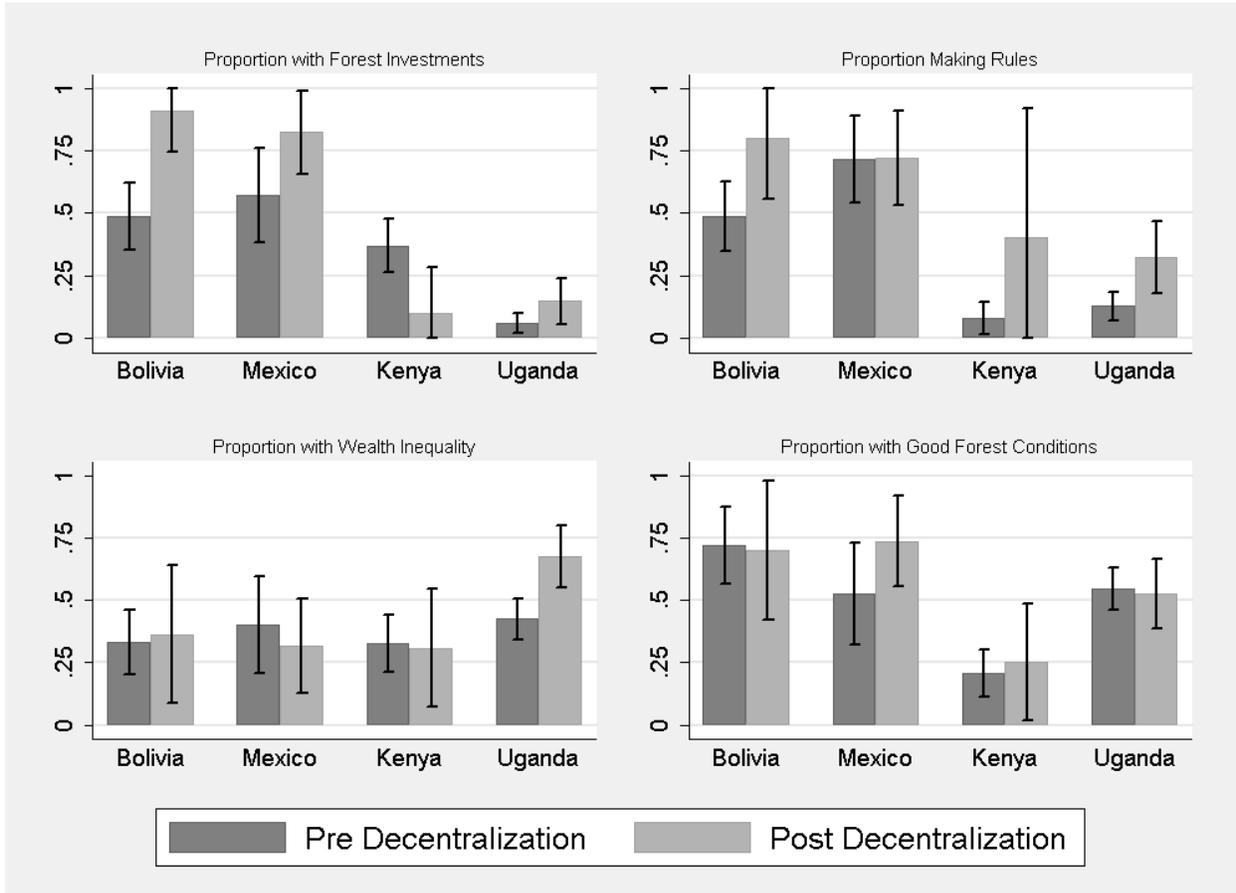


Figure 1. Distribution of Dependent Variables Before and After Decentralization by Country *Mean levels of user group behavior both before and after decentralization and 90% normal confidence intervals for those means.*

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. 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

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.⁴³ 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.⁴⁴

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.⁴⁵ 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. for use in Stata.⁴⁶ 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.

5.1 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. 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)

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

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 ($p < 0.01$).

5.2 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.

5.3 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 ($p < 0.01$).

5.4 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.

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.⁴⁷ 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 in 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.⁴⁸ 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 and Gibson (2007), to research the environmental outcomes of decentralization policies.⁴⁹ 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.⁵⁰

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.

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

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.

Appendix B IFRI Question for analyzed variables

B.1 Making Rules

Are there some individuals in this user group responsible for making rules about the forest?

(Yes/No)

B.2 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)

B.3 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.

B.4 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

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³⁵ See Friedrich A. von Hayek, "The Economic Conditions of Interstate Federalism," *New Commonwealth Quarterly*, 131 (1939), 49. In Friedrich A. von Hayek, "The Use of Knowledge in Society," *American Economic Review*, 35 (1945), 519-530, he 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 Elinor Ostrom, Larry D. Schroeder, and Susan G. Wynne, *Institutional Incentives and Sustainable Development: Infrastructure Policies in Perspective*, (Boulder, CO: Westview Press, 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, Fikret Berkes, *Sacred Ecology: Traditional Ecological Knowledge and Resource Management* (Philadelphia: Taylor & Francis, 1999); Jared M. Diamond, "Zoological Classification System of a Primitive People," *Science*, 151 (1966), 1102-1104; Madhav Gadgil and Fikret Berkes, "Traditional Resource Management Systems," *Resource Management and Optimization*, 8 (1991), 127-141; Madhav Gadgil, Fikret Berkes, and Carl Folke, "Indigenous Knowledge for Biodiversity Conservation," *Ambio*, 22 (1993), 151-156. 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 Robert M. Netting, *Balancing on an Alp* (Cambridge: Cambridge University Press, 1981); James M. Acheson, *The Lobster Gangs of Maine* (Lebanon, NH: University Press of New England, 1988); David Feeny, Fikret

Berkes, Bonnie J. McCay, and James M. Acheson, "The Tragedy of the Commons: Twenty-two years later," *Human Ecology*, 18 (1990), 1-19; Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990); Elinor Ostrom, Roy Gardner, and James M. Walker, *Rules, Games, and Common-Pool Resources* (Ann Arbor: University of Michigan Press, 1994).

³⁶ Daniel Treisman, *The Architecture of Government: Rethinking Political Decentralization* (New York: Cambridge University Press, 2007).

³⁷ Stuart Corbridge and Sarah Jewitt, "From forest struggles to forest citizens? Joint Forest Management in the unquiet woods of India's Jharkhand," *Environment and Planning A*, 29 (1997), 2145-2164.

³⁸ Tanya M. Hayes, "Parks, People, and Forest Protection: An Institutional Assessment of the Effectiveness of Protected Areas," *World Development*, 34 (2006), 2064-2075; Eric A. Coleman, "Institutional factors affecting biophysical outcomes in forest management." *Journal of Policy Analysis and Management*, 28 (2009), 122-146.

³⁹ Krister P. Andersson, Clark C. Gibson, and Fabrice Lehoucq, "The Politics of Decentralized Governance of Natural Resources," *PS: Political Science and Politics*, 37 (2004), 241-248.

⁴⁰ Pranab K. Bardhan and Dilip Mookherjee, "Capture and Governance at Local and National Levels," *American Economic Review*, 90 (2000), 135-39; John Harris, J. Kristian Stokke, and Olle Törnquist, eds., *Politicizing Democracy: The New Local Politics of Democratization* (New York: Palgrave Macmillan, 2005); Jean-Philippe Platteau, "Monitoring Elite Capture in Community-Driven Development," *Development and Change*, 35 (2004), 223-46; Clarissa Rile Hayward, "The Difference States Make: Democracy, Identity, and the American City," *American Political Science Review*, 97 (2003), 501-14.

⁴¹ Pamela Jagger, “Renegotiating Livelihoods after Uganda's Forest Sector Reform” (Ph.D. diss, Indiana University, 2009).

⁴² Coleman, 2009.

⁴³ For a more complete explanation of the probit model, see J. Scott Long *Regression Models for Categorical and Limited Dependent Variables* (Thousand Oaks, CA: Sage Publications, 1997).

⁴⁴ For this estimation we used the software NNMatch. See, Alberto Abadie, Jane Leber Herr, Guido W. Imbens, and David M. Drukker, “Implementing matching estimators for average treatment effects in Stata,” *The Stata Journal*, 4 (2004), 290-311. 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 S. L. Morgan, S.L. and David J. Harding, “Matching Estimators of Causal Effects: Prospects and Pitfalls in Theory and Practice,” *Sociological Methods & Research*, 35 (2006), 35-60. 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.

⁴⁵ Morgan and Harding, 2006.

⁴⁶ Abadie et al., 2004.

⁴⁷ Abwoli Y. Banana, Nathan D. Vogt, William Gombya-Ssembajjwe, and Joseph Bahati, “Decentralized governance and ecological health: why local institutions fail to moderate deforestation in Mpigi district of Uganda,” *Scientific Research and Essay*, 2 (2007), 434-445; Eric A. Coleman, John Kershaw, Burnell Fischer, “Using Stocking Guides to Take Stock of Forest Institutions,” Workshop in Political Theory and Policy Analysis Working Paper (Bloomington, IN: Indiana University, 2009); Jagger, 2009.

⁴⁸ See Agrawal and Ribot (1999).

⁴⁹ Krister P. Andersson and Clarke C. Gibson, “Decentralized Governance and Environmental Change: Local Institutional Moderation of Deforestation in Bolivia,” *Journal of Policy Analysis and Management*, 26 (2007), 99-123.

⁵⁰ On the other hand, user group perceptions of decentralization impacts may be just as interesting as more objective measures of the impacts.