

**A New Perspective on Community Governance of Forests in Bolivia:
The Role of External Organizations**

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Abstract

Most contemporary scholarship on decentralization assesses the impacts of these reforms by studying the decisions and activities of local government administrations: the targeted actors of the decentralization reforms. In Latin America, the most common targeted actors are municipal governments. Meso-level analyses of this sort fail to capture an important determinant of aggregate governance performance: the institutional conditions for community self-governance. These conditions can only be observed by finer-scaled analysis of community organization. In Bolivia, for example, there are often hundreds of local communities within a single municipal territory.

We argue that to come to come up with more nuanced explanations of the mixed governance outcomes of Bolivia's decentralized forest policy, scholars need to engage in multi-level analyses that include outcomes at sub-municipal levels. Our empirical analysis tests and discusses some of the conditions that are believed to be conducive to community self-governance of forests in Bolivia. In particular, we compare and contrast the effects of repeated interactions between local communities and a variety of external actors, including NGOs, local governments, regional as well as central government agencies on the likelihood of self-organization for forest governance. Controlling for the security of property rights as well as a range of documented determinants of effective self-governance, we find that of all the external actors that rural villages interact with it is the relatively frequency with which they interact with municipal government that has the most consistently positive effect on their efforts of self-governance.

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Introduction

There is no shortage of bad news about the world's forests. Despite two decades of unprecedented international efforts to curb deforestation, the latest estimate from the Food and Agriculture of the United Nations is that primary forest loss is not slowing down (FAO, 2006). Moreover, the fourth assessment report from the Intergovernmental Panel on Climate show that CO₂ emissions related to tropical deforestation now constitutes over 20 percent of total global GHG emissions (IPCC, 2007).

The loss of forests is not just an ecological tragedy but also a human one. Forest loss in non-industrialized societies often disproportionately hurt the already vulnerable segments of such societies: rural populations that rely mostly on subsistence agriculture and natural resources management (Forest Trends, 2005). Many of these rural populations depend directly on forests for their survival. Despite the high social costs of tropical deforestation, there is surprisingly little scientific research on why current policies have failed and how new policies might do a better job. One of the critical questions in the debate about forest policy alternatives for non-industrial countries concerns the role of rural communities in forest policy reforms. This paper addresses this question by analyzing the conditions under which community self-governance of forests is feasible.

There has been a noticeable shift in the field of contemporary forest policy. Policies are different today in most countries with regards to the rights and responsibilities of local forest users. While traditional policies emphasized the industrialization of forestry and the promotion of large-scale export oriented logging

business, today's policies emphasize the participatory approach to forest governance, in which local forest users enjoy stronger user rights to forests.

Policies in support of community forestry vary vastly from one country to the next. In Nepal, for example, rural communities that have been granted vast usufruct rights to manage and harvest forest resources to their exclusive benefit. In neighboring India, users enjoy weaker property rights than in Nepal, as communities are obliged to share any monetary income from forestry with central and state government officials. In Latin America, Mexican communities probably have the strongest bundle of property rights related to forestry of all countries in the region. Rural communities there actually own the vast majority of the country's natural forests. In Bolivia, forest communities have recently gained new usufruct rights to forests, which were previously reserved for firms and powerful individuals to whom the government granted logging concession rights. Today, Bolivian communities and individual land owners can extract forest products for domestic use without applying for government permits.

The failure of international and most national forestry policies to curb deforestation has called into question the effectiveness of state-centered intervention approaches that seek to boost forest conservation through the implementation of a series of command and control instruments, such as the expansion of protected areas, logging bans, and subsidy programs (Brockington, 2002; Covey, 1995; Pfaff et al., 2007). Critics argue that not enough recognition has been given to the role of rural communities in stemming deforestation (Poffenberger, 2001; Donovan, 2001). Several international and national organizations are now aggressively pushing for programs that emphasize community-based natural resource management as a strategy to save the forest from

widespread conversion to other land-uses. Many advocates of such community-based approaches draw on the findings from common property research that shows that community self-governance is not only possible but it often trumps government in terms of conservation cost-effectiveness (Forest Trends, 2005; Wily and Mbaya, 2001).

More than two decades of mainstreamed policies on CBNRM and community forestry has produced very mixed results. (McShane and Wells, 2004) and while most analysts now agree that such policies community-centered initiatives are necessary, it remains an open question how new policies and actions might bring about more successful self-governance of natural resources.

One of the most robust findings in the literature on community forestry is that local outcomes depend on the strength of local institutional arrangements to regulate forest use (Ostrom, 1999; Gibson et al, 2000), and in particular on the rigor and intensity of self-organized institutions for rule monitoring and enforcement (Gibson et al, 2005; Agrawal and Chatterjee 2006; Coleman, 2009). In *Governing the Commons*, Elinor Ostrom examines hundreds of self-organized CPR systems, both successes and failures, and found that several institutional design features are commonly found in successful self-organized CPR institutions (Ostrom 1990). These design features include (i) the presence of boundary rules, stipulating which agents have access to the common; (ii) the presence of authority rules relating to allocation; (iii) active forms of monitoring and sanctioning; (iv) and a system of gradual sanctions (Ostrom et al., 1994: 301-302)

Less conclusive findings exist with regards to the factors that allow for the *emergence of effective self-government* of forest resources. This is a critical question for

actors interested in making community forestry and other community-based strategies work. This is the question that this paper addresses.

The paper next turns to a review of previous research that addresses the emergence of collective action for natural resources use, and identify areas in which researchers have been less successful in providing answers. I end the literature review by stating my main research hypothesis and move on to describe the context in which I test the theoretical proposition: a nationally representative sample of 200 rural communities in Bolivia. I then proceed to lay out the defining characteristics of community forestry in Bolivia, and describe our data collection methods. The empirical analysis of our data follows before I end the paper with a discussion about how the results inform current research and policy agendas.

Previous Research

Why do some local communities develop strong self-government to manage their common pool resources, while others fail to do so? Mostly case studies of isolated experiences address this question. Gibson and Becker (2000) find that communities that perceive forest resources to be scarce but salient to their livelihoods are more likely to self-organize forest governance activities (p45). Ostrom (1990) postulates that the self-organization of governance arrangements for common pool resources, such as forests, is a second-order collective action problem. She suggests that the likelihood of individuals investing their time and effort to discuss, negotiate, and agree on the creation of an institutional arrangement to regulate their own use of the CPR is related to the resource

users' perceived balance of costs and benefits that flow from such an investment. These costs and benefits, in turn, are largely determined by two basic conditions: the attributes of the resource and the characteristics of the resource user groups. If, for example, the forest that a community uses is of relatively low value to the community members' livelihoods, the perceived benefits may not add up to match the perceived costs of self-organizing regulated access and extraction, and the users' incentives for self-organization may be too weak to even try regulating the CPR. Many exogenous factors are likely to intervene to affect this likelihood, such as the general level of trust with the community, the community members' discount rates, and the potential economic benefits from more regulated forest use (Ostrom, 1999).

Along the same lines, Anderson and White (1995) analyze the origins of collective action in a Haitian watershed and find that the emergence of self-governance of collective resources may be constrained by "landscape factors that affect the potential net economic gain, and sociocultural factors that affect the cost of constructing the new institution" (1995).

In the broader collective action literature, several authors offer ideas about the origins of self-organization. Olson (1965) argued that disparities of wealth may provide the impetus for some individuals, who have a larger stake in the resource condition and therefore assume the high start-up costs, to facilitate the creation of governance arrangements. Molinas (1998), in contrast, identified a less monotonic relationship between socioeconomic heterogeneity and collective action. He suggests, on the basis of an econometric analysis of 104 local organizations, that the relationship is in fact U-

shaped. Low and high levels of inequalities are associated with lower likelihood of cooperation, and medium levels associated with higher levels of performance.

At the heart of the issue of how self-governing CPR institutions evolve is the problem of how short-term self-interest may be transformed into effective cooperation. Using computer simulations, Axelrod (1984) shows that simple tit-for-tat strategies explain how egoistic individuals who engage in repeated interactions can self-organize to solve complex collective action dilemmas similar to CPR problems. Applied to the challenge of supporting community-organized institutions for forest commons, Axelrod's findings point to the importance of repeated interactions between resource users. It also raises the possibility that the creation of productive reciprocity between resource users is something that external agents may be able to encourage and support. The question is how policy actors interested in strengthening the local institutions for forest governance may do so productively.

The existing literature on community forestry provides little guidance on the question of how productive support system for self-governance may be structured. For example, are there some types of intervening organizations that are more important to self-governance of forests than others? Recent case study findings from the community-based NRM suggest that NGOs are more likely than governmental organizations to facilitate successful collective action in resource-dependent communities (Suich et al, 2008; Child, 2008). Some go as far as suggesting that NGOs support to CBNRM may be viewed as a response to government-led failures of conservation and sustainable resource management (Redvers, 2009).

The polycentricity literature suggests that there is a variety of functions that external agents may fulfill to support CPR self-governance (for reviews see McGinnis, 2000 and Ostrom, 2005). Some of the specific actions that external organizations can take to support self-organized community governance systems include providing forums for conflict resolution, facilitating information-sharing about resource systems and possible problem-solving alternatives, and offering legal back-up to local efforts of monitoring and enforcement (Andersson and Ostrom, 2008).

This review of some of the relevant research in this area reveals the need for a deeper understanding of the role of external organizations in strengthening local rule-making, monitoring and enforcement in the area of forest governance. Our research seeks to build on Axelrod's original idea about the centrality of repeated interactions in the development of cooperation through reciprocity and trust and apply this concept to the relationships between local communities and variety of external agents. We test the influence that interactions with external organizations have on local communities' achievements of self-governance of forest resources. *We hypothesize that the more closely associated that communities are with NGOs and other external agents, the more likely they are to self-organize forest governance activities.* We test this hypothesis in the context of community-managed forests in Bolivia.

Background: Community Forestry in Bolivia

Like other rural populations throughout Latin America, rural communities in Bolivia rely on forests to satisfy many essential subsistence needs. Forests provide products such as

fuelwood, fruits, nuts, fibers, medicinal plants, and wood for construction. According to the 2001 national census, 41.7 per cent of the country's entire population—rural and urban—rely on firewood as their primary source of energy for cooking (Government of Bolivia, 2002). Smallholder agricultural production constitutes a very important part of agricultural activities in Bolivia's total agricultural production, more so than in any other country in Latin America (FAO 1988).

Through the 1996 forestry law, the commercial extraction of forest resources became a possible source of income for all Bolivian communities. While timber extraction is often mentioned as the most significant income-enhancing activity, the law also provides for the possibility to acquire alienation rights for a variety of other, nontimber forest products such as nuts, grasses, and mushrooms. In an increasingly specialized market economy, rural settlers need cash to acquire many essential household items, such as food, farming equipment, healthcare, and school fees. Unlike household consumption, however, the commercial extraction of forest resources requires the forest users to comply with a large number of government regulations. The problem for many smallholder farmers in the Bolivia is that it can be both costly and complicated to obtain the necessary government permits. Recent government initiatives seek to overcome these hurdles to community-based forest governance through the promotion of community forestry that directly target rural communities.

In 2008, the Government of Bolivia introduced a new community forestry program that seeks to provide direct financial and technical support from central government ministries and agencies to rural communities for forest management. The details of how such a program will work in practice are still being worked out by the

central government. For example, it is not clear how the interactions between local communities will be organized. Another uncertainty is the intended role of NGOs and local governments in the new program. The empirical analysis in the next part of the paper seeks to shed light on the importance of these relationships, which will hopefully help inform the design of the new community forestry program in Bolivia.

Data and Methods

We took to the field in Bolivia to collect data on forest characteristics, demographics, decision making and governance activities in 200 rural communities. We selected these communities through a two-stage sampling process. First, we randomly selected 100 municipal territories. For each municipal territory, we documented the distance between each community and a major road. To save costs, we eliminated all communities from our sample list whose distance to a major road exceeded 50 km. From the list of remaining communities, we randomly selected two.

In each selected community, our field team conducted a one-day workshop in which a series of questions were discussed. The results of the discussions were coded into a data base. The data we use for our empirical tests in this paper are described in some detail in the next section.

Dependent Variables

As outcomes, we employ three proxy measures that represent self-organized governance arrangements related to forest use: (1) Self-organized rule systems; (2) Self-organized monitoring and enforcement activities, and (3) self-organized sanctioning activities. The

distribution of the three binary variables is presented in Figure 1 below. It is worth noting that less than half of all sampled communities self-organize to govern forest use.

[Figure 1 about here]

Independent Variables

Given our theoretical focus and the findings from previous research, we specify a conceptual model that includes eleven independent variables. What follows is a brief description of these variables, including our predicted effect of these on self-organized forest governance in Bolivia.

Forested land (%): We asked respondents what proportion of their community's land is currently covered by forest. We predict that the less forest cover a community has, the more likely it is to engage in self-governance activities to protect the little forest they have.

Distance to Health Center: We asked respondents about the distance (in km) to the nearest clinic. We predict that this variable, which is a proxy for infrastructure development, is negatively correlated with self-governance activities because residents of communities that enjoy better infrastructure are less likely to be economically dependent on forest resources (less salience of forest for subsistence).

Population growth rate: We asked local community members about the current population count as well as the corresponding figures for ten years ago. Based on these self-reported figures we calculated the ten-year population growth rate. We predict that

places with high growth rates are more likely to self-organize forest governance because of the increased pressure on the forest resources.

Literacy rate: We asked what proportion of adult community members know how to read and write. The higher the literacy rate—a proxy measure of human development—the more likely it is for the community to self-organize forest governance activities because short-term subsistence needs are more likely to be satisfied in such places.

Wealth difference: In one of our final questions, we asked community members who attended our one-day workshop about how they would characterize disparities of wealth within their community. We asked them to think about community members' individual land holdings and assign a number from 1-10 to describe the intra-community differences. Our prediction is that the higher the perceived wealth disparities, the more difficult it is for the community to collaborate and to agree on institutional arrangements to regulate forest use.

Forestry Salience: As another proxy for the salience of forest use (in addition to distance to health center) we created a variable based on the responses to the question: “If you received a cash donation of USD \$1,000, what percentage of this sum would you invest in forest management?”. The higher the percentage, the more salient the forest is for the economic well-being of the community.

Formal title: In Bolivia all communities are going through a national program for land titling. We asked community members at what stage in this process they were. If they had had the initial study concluded we assigned a value of 1, if they had already received their title, we assigned a 2.

Central interactions: The relative frequency with which community members reported to be interacting with representatives from central government agencies regarding forest use. For all the variables that describe the relative frequency of interactions with these actors, we predict that the more frequent the encounters, the higher the likelihood of observing self-organized governance activities. We support this prediction with findings from literature on polycentric governance that states that more connected communities tend to be more effective problem-solvers.

Prefecture interactions: The relative frequency with which community members reported to be interacting with representatives from the departmental government regarding forest use.

Municipal interactions: The relative frequency with which community members reported to be interacting with representatives from the municipal government regarding forest use.

NGO interactions: The relative frequency with which community members reported to be interacting with representatives from non-governmental organizations regarding forest use.

The definitions and descriptive statistics for each of all variables used in the subsequent empirical tests are presented in Table 1 below.

[Table 1 about here]

Empirical Results

The results of the three logistic regression models, which are presented in Table 2 below, suggest that autochthonous forest governance arrangements in Bolivia are systematically associated with relatively frequent interactions with municipal government officials and *not* with NGOs or governmental agents at regional or central levels. The variable Municipal Interactions have a consistent and statistically significant positive effect on all three measures of local institutional arrangements.

As municipal interactions move from its lowest to highest value, the probability that a community will have developed their own rules to regulate forest use increase by 22 percent, and the probability that it will actively monitor and enforce those rules increase by 32 percent (while holding all other variables constant at their means).

We believe this finding is related to the fact that municipal governments constitute the most important support structure for self-organized forest governance in Bolivia. It represents a resource for communities that may need help in terms of technical expertise, legal protection and back-up, administrative assistance in acquiring harvesting permits, or just to lend a hand in the implementation of larger community actions.

Although NGOS were present in all the 200 municipalities, these often target specific communities and many communities in need do not benefit. In a similar fashion, the prefecture and central government representatives have representatives in all municipalities, but they often lack the human resources to engage directly with all communities that solicit their support. They are forced to be selective in the communities

that they do decide to assist. Municipal government is likely to be the most widely accessible organization for rural communities in Bolivia.

[Table 2 about here]

The level of infrastructure development of the location has a more ambiguous affect on outcomes. In the first model, the nearer a community is located to a health center the more likely it is to observe self-organized institutions that regulate forest use, but the effect on the probability of community sanctioning is the exact opposite. Not surprisingly, the more forest cover a given community has, the more likely it is to have self-organized monitoring, enforcement, and sanctioning.

Contrary to conventional wisdom, we do not see any significant impact of NGO interactions on self-organized forest institutions. And the only significant effect of interactions with central government agents that our analysis picks up, is actually negative: the more frequent interactions a community has with central government representatives, the less likely it is to self-organize sanctioning of transgressors. This result is likely due to the perceived high costs of imposing sanctions on community members, and as a result communities are likely to ask central government agents to do this for them. That is probably why we see less local sanctions in communities with relatively high frequency of interactions with central government agencies.

Conclusion

Evidence of mixed outcomes related to community forestry programs and their effectiveness in supporting community self-governance of forest resources raises

questions about the factors that affect the formation of autochthonous rule making, monitoring, enforcement and sanctioning. This paper suggests that one potentially important factor is often ignored in research on CBNRM: the importance of repeated interactions with external agents. Such interactions have the potential to provide local communities with much needed inputs to make their self-governance efforts successful. These inputs may be in the form of providing technical expertise in support of every-day problem solving, facilitating information exchange with other rural communities, making forums for conflict resolution available, and offering legal back-to the communities' efforts to monitor and enforce their local rule systems.

The main finding of the paper—that relatively frequent interactions with local government representatives seem to increase the likelihood of a community developing their own forest governance institutions—has implications for current efforts to promote community forestry in Bolivia. The new programs would benefit from explicitly considering a possible role for the country's municipal governments, especially in the rural areas where they are often the only organization that is generally accessible to local residents.

The surprising result that the frequency of interactions with NGOs does not have a statistically significant effect on the prospects of community self-governance does not mean that municipal governments are necessarily better or more effective than NGOs in facilitating community self-organization. The results are likely to be related to the fact that municipal governments are uniquely positioned in the types of assistance that they may provide and that they are often more accessible to all communities that are interested in forest governance.

Future research in this area would benefit from considering more qualitative analysis of the details in the relationship between local governments and forest-dependent communities in Bolivia. Such analysis would help provide more nuanced explanations to the quantitative results.

Sources Cited

- Agrawal, A., and A. Chhatre. 2006. Explaining success on the commons: community forest governance in the Indian Himalaya. *World Development* 34:149-166.;
- Alden Wily, L. and Mbaya, S. 2001. Land, people and forest in Eastern and Southern Africa at the beginning of the 21st century. The impact of land relations on the role of communities in forest future. Nairobi, Kenya: IUCN-EARO. Keywords: East Africa, forest, land, Southern Africa.
- Andersson, K. 2004. Who Talks With Whom? The Role of Repeated Interactions in Decentralized Forest Governance. *World Development* Vol 32(2): 233-249.
- Andersson, K. and Ostrom, E. 2008. Analyzing Decentralized Natural Resource Governance from a Polycentric Perspective. *Policy Sciences* 41(1):1-23.
- Andersson, K. and Pacheco, D. 2006. Turning to Forestry for a Way Out of Poverty: Is Formalizing Property Rights Enough? In B. Guha-Khasnobis, R. Kanbur and E. Ostrom (Eds) *Linking the Formal and Informal Economy: Concepts and Policies*. Oxford, UK: Oxford University Press.
- Axelrod, R. 1984. *The Evolution of Cooperation*. Basic Books.
- Brockington, D. 2002. *Fortress Conservation: The Preservation of the Mkomazi Game Reserve, Tanzania*. Bloomington, IN: Indiana University Press.
- Child, B. 2008. Community Conservation in Southern Africa: Rights-Based Natural Resources Management. In H. Suich, B. Child, and A. Spenceley (Eds). *Evolution and Innovation in Wildlife Conservation: Parks and Game Ranches to Transfrontier Conservation Areas*. London, UK: Earthscan
- Coleman, E.A. 2009. Institutional factors affecting biophysical outcomes in forest management. *Journal of Policy Analysis and Management* 28 (1) 122 – 146
- Covey, J. 1995. J. Covey, Accountability and effectiveness in NGO Policy Alliances”, in M. Edwards and D.Hulme (eds), *Beyond the Magic Bullet: NGO Performance and Accountability in the post Cold-War World*. London: Earthscan and West Hartford: Kumarian Press.
- Donovan, R. 1995. BOSCOA: Forest Conservation and Management Through Local Institutions (Costa Rica). In D. Western, S.C Strum, and R.M. Wright (eds.) *Natural connections: perspectives in community-based conservation* Island Press, Washington, DC.
- FAO (Food and Agriculture Organization) of the United Nations (1988). *La Participación Campesina en el Desarrollo Rural*. Santiago, Chile: La Oficina Regional de la FAO para America Latina y el Caribe.
- FAO (Food and Agriculture Organization of the United Nations) 2006. *Global Forest Resources Assessment 2005*. Rome, Italy: FAO
- Forest Trends, 2005. *A New Global Initiative Advancing Forest Tenure, Policy and Market Reforms to Reduce Rural Poverty, Strengthen Forest Governance, Conserve and Restore Forest Ecosystems and Achieve Sustainable Forest-Based Economic Growth. Concept Note*. Washington, DC: Forest Trends
- Gibson, C. and C. D. Becker. 2000. Lack of institutional demand: Why a strong local community in western Ecuador fails to protect its forest. In: Gibson, Clark,

- Margaret McKean, and Elinor Ostrom, eds. *People and Forests: Communities, Institutions, and the Governance of Forests*. Cambridge, MA: MIT Press.
- Gibson, C. M. McKean and E. Ostrom (2000). *People and Forests: Communities, Institutions and Governance*. Cambridge, MA: MIT Press.
- Gibson, C., J. Williams, and E. Ostrom. 2005. Local enforcement and better forests. *World Development* 33:273-284.
- Government of Bolivia (2002). Censo Nacional 2001. La Paz, Bolivia: Instituto Nacional de Estadísticas (INE).
- IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland.
- McGinnis, M. D. 2000. Polycentric Games and Institutions: Readings from the Workshop in Political Theory and Policy Analysis. University of Michigan Press.
- McShane, T. O. and M. P. Wells (Eds) 2004. *Getting biodiversity projects to work: towards better conservation and development*. Columbia University Press, New York, New York, USA.
- Molinas, J.R. 1998. The impact of inequality, gender, external assistance and social capital on local level collective action *World Development* 26:413-431.
- Olson, M. 1965. *The Logic of Collective Action: Public Goods and the Theory of Groups* Cambridge: Harvard University Press.
- Ostrom, E. 1990. *Governing the commons: the evolution of institutions for collective action*. Cambridge University Press, Cambridge, UK.
- Ostrom, E. 2005. *Understanding institutional diversity*. Princeton University Press, Princeton, New Jersey, USA. Ostrom, E., R. Gardner, and J. Walker (1994). *Rules, Games, and Common-Pool Resources*. Ann Arbor, MI: University of Michigan Press.
- Ostrom, E. 1999. Self-governance and forest resources. *Occasional Paper 20*. Bogor, Indonesia: Center for International Forest Research.
- Pfaff, A., Kerr, S. Lipper, L. Cavatassic, R. Davis, B. Hendy, J. and Sanchez-Azofeifad, G.A. 2007. Will buying tropical forest carbon benefit the poor? Evidence from Costa Rica. *Land Use Policy* 24(3): 600-610
- Poffenberger, M. 1995. The Resurgence of Community Forestry in Eastern India. In D. Western, S.C Strum, and R.M. Wright (eds.) *Natural connections: perspectives in community-based conservation* Island Press, Washington, DC.
- Redvers, L. 2009. Angola: NGOs Sceptical of Govt's Rural Development Plans. Inter Press Service. June 6, 2009. Accessed on June 17, 2009 on www.Allafrica.com
- Suich, H. Child, B. and Spenceley., 2008. A. Evolution and Innovation in Wildlife Conservation: Parks and Game Ranches to Transfrontier Conservation Areas. London, UK: Earthscan
- White, T.A. and C.F. Runge. 1995. The emergence and evolution of collective action: Lessons from watershed management in Haiti. *World Development* 23(10):1683-1698

Table 1: Variable definitions and descriptive statistics

Variable	Description	Obs	Mean	Std.	Min	Max
Own Rules	Has community developed its own forest-use rules?	200	0.415	0.494	0	1
Own M&E	Does community monitor and enforce forest use rules?	200	0.265	0.442	0	1
Own Sanctions	Does the community sanction transgressors?	200	0.230	0.422	0	1
Forested land (%)	Percent of community land that is forested	200	29.13	26.82	0	99
Distance to Health Center	Distance to nearest health clinic in km	200	6.091	9.205	0	65
Population growth rate	Population growth 1998-2008	200	43.91	350.9	1.00	4599
Literacy rate	Percent of community that is literate	200	79.85	19.97	10	100
Wealth difference	Ordinal measure of intracommunity differences in land holdings	200	5.250	2.618	1	10
Forestry Saliency	If community received \$1,000 what percentage would it invest in forestry?	200	13.98	24.32	0	100
Formal title	Stage of title formalization process	200	0.565	0.507	0	2
Central interactions	Ordinal frequency of interactions with central government representatives	200	0.175	0.544	0	3
Municipal interactions	Ordinal frequency of interactions with municipal government representatives	200	0.990	1.147	0	3
NGO interactions	Ordinal frequency of interactions with NGO representatives	200	0.525	0.862	0	3
Prefecture interactions	Ordinal frequency of interactions with prefecture representatives	200	0.465	0.924	0	3

Table 2: Binary logistic regression results

<i>Independent Variables</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>
	<i>Own forest rules</i>	<i>Own M&E</i>	<i>Own Sanctions</i>
Forested land (%)	0.010 (0.007)	0.027 (0.009)***	0.024 (0.009)***
Distance to Health center	0.043 (0.019)**	0.024 (0.018)	-0.056 (0.026)**
Population growth rate	0.000 (0.000)	-0.000 (0.001)	-0.088 (0.067)
Literacy rate	-0.001 (0.008)	0.002 (0.010)	-0.008 (0.010)
Wealth difference	0.047 (0.066)	-0.217 (0.083)***	-0.099 (0.083)
Forestry Saliency	-0.019 (0.008)**	-0.013 (0.008)	-0.009 (0.008)
Formal property rights	-0.407 (0.331)	-0.437 (0.394)	-0.011 (0.397)
Central interactions	0.218 (0.349)	0.319 (0.348)	-0.721 (0.392)*
Municipal interactions	0.291 (0.158)*	0.584 (0.185)***	0.423 (0.179)**
NGO interactions	0.094 (0.193)	-0.129 (0.225)	0.234 (0.214)
Prefecture interactions	0.184 (0.191)	-0.157 (0.215)	-0.128 (0.209)
Constant	-1.06 (0.848)	-1.32 (1.04)	-0.662 (1.02)
Observations	200	200	200
LR chi2(11)	30.34	46.17	34.14
Prob > chi2	0.001	0.000	0.000
Pseudo R2	0.112	0.200	0.158

* significant at the 90-percent level

** significant at the 95-percent level

*** significant at the 99-percent level

Figure 1: Distribution of Dependent Variables

