

Inequalities, Institutions, and Forest Outcomes

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ABSTRACT

This paper contributes to a growing literature on the commons that examines the relationship between inequality and commons outcomes. Our analysis of evidence on forest commons outcomes in 228 cases from South Asia (India and Nepal), East Africa (Kenya and Uganda) and Latin America (Mexico and Bolivia) suggests that local governance and collective action matter in shaping how socioeconomic inequalities affect forest conditions. In particular, we find that both inter-group and intra-group economic inequalities have consistently negative effects on forest outcomes, but that local institutions for collective action dampen the negative effect of inter-group inequality on forest outcomes.

Keywords: forest commons, economic inequality, governance, collective action,

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INTRODUCTION

Since 1985, the volume of writings on the governance of natural resource commons and the diversity of questions addressed through this work has grown rapidly, particularly after the publication of Ostrom's *Governing the Commons* (Ostrom 1990, NAS 2004). The greater proportion of this literature continues to focus on whether and how local governance institutions contribute to sustainable management of resources. Examining this general question under diverse ecological and political-economic conditions, and with reference to many different types of resources and groups of peoples, writings on the commons have been singly important in showing the capacity of users to self organize, work with government officials, and take advantage of opportunities to govern their resources sustainably.

One of the major theoretical and policy issues that writings on resource governance can explore more carefully is the relationship between equality and governance outcomes (Leach et al. 1999). To be sure, many scholars interested in local level sustainable outcomes either assert or imply a positive relationship between greater socio-economic equality and more sustainable resource use and governance (Trawick 2001; Budhathoki 2004). Others point to the adverse effects of inequalities on the efficiency of resource use and governance processes (Banerjee et al. 1997; Chatterton and Chatterton 2001, Corbera et al. 2007, Smith 2004). But research focusing directly on the relationship between social or economic equality and its relationship with institutional arrangements and ecological sustainability remains rare despite important recent

contributions (Varughese and Ostrom 2001, Adhikari and Lovett 2006) and despite attention to the unequal outcomes that may result even when resources are managed by communities or locally organized community institutions (Agarwal 1998, Adhikari 2005; Lopez-Feldman et al. 2007). At least part of the reason for the limited consensus on how inequality affects environmental outcomes lies in the diverse dimensions along which inequality can exist (Rae 1981, Sen 1995, Velded 2000), the potentially different impacts of social, political, as well as economic inequalities on ecological outcomes (Dayton-Johnson 2000), and the significant difficulties in generating measures of equality that capture its many different dimensions and their potentially divergent effects on resource governance outcomes (Prasad et al. 2006).

An additional feature of the research on commons is that the existing knowledge about the relationship between equality and sustainability is based primarily on studies of specific cases of resource governance, or statistical analyses of data from specific countries, notable exceptions notwithstanding (cf Koop and Tole 2001). This available work on the relationship between inequalities and resource outcomes has greatly improved existing knowledge about specific cases and multiple cases from specific countries, but has been less successful in generating conclusions based on empirical evidence from multiple cases from multiple countries. The ensuing study seeks to make a contribution to the understanding of how equality and ecological sustainability are related by drawing upon data from multiple localities in several countries in the developing world. The study is based on data collected jointly by researchers involved in the International Forestry Resources and Institutions research program based at the University of Michigan and Indiana University in the United States (see

www.umich.edu/~ifri). The primary methodological justification for the use of data at the local level is that given the local nature of most renewable resource governance, the proximate factors that influence the relationship between equality and sustainability are also likely to be most visible at the local level.

The arguments in our paper concern inequality-related factors that shape outcomes on forest commons, and are based on evidence from 228 cases in which different user groups depend on forests without being full owners of their forests (Schlager and Ostrom 1992). The cases are drawn from six countries: India and Nepal in South Asia; Kenya and Uganda in East Africa; and Bolivia and Mexico in Latin America. We employ both qualitative and quantitative methods to analyze the role of local institutional arrangements in explaining the relationships between socioeconomic inequalities and environmental change in local forest resources.

The generalizability of our findings, based on local-level evidence from multiple countries and contexts, is open to methodological questions because of potential concerns about whether our sample is representative of forest commons governance arrangements in the selected countries. However, findings of all studies of commons are particularly prone to generalizability-related questions because comprehensive lists of forest commons in a country do not yet exist. At the same time, comparative work based on data from multiple countries and locations has the potential to yield generalizations that overcome at least some basic issues of methods concerning the number of variables that affect outcomes on forest commons (Agrawal, 2001). The arguments offered in our study are especially relevant given the critical nature of the relationship between inequality, institutions, and ecological sustainability. Based on our findings, we identify some new

areas for future research to explicate further the socioeconomic, biophysical and institutional conditions under which equality affects ecological sustainability.

The next section reviews the existing literature on the relationship between equality and ecological sustainability and examines the role of local governance in influencing this relationship. We illustrate our argument about the role of local institutional arrangements by examining four forest-dependent communities. Based on this comparative analysis, we develop a series of hypotheses, tested with multivariate regression techniques in subsequent sections. Section 3 describes the field work methods and the data. Section 4 presents the analysis and its results. We end with a discussion of the results and their implications for future research on local governance and equalities. Our conclusions highlight the importance of institutions and the moderating role they play in influencing effects of socio-political and economic inequalities on natural resource outcomes.

INEQUALITY AND ITS EFFECTS: THEORY AND EMPIRICAL EVIDENCE

Several recent studies on collective action and the commons have analyzed the relationship between inequality/heterogeneity, governance, and ecological sustainability (Varughese and Ostrom 2001, Poteete and Ostrom 2004, Adhikari and Lovett 2006). This work has highlighted both positive and negative ways in which social and economic heterogeneities can affect resource governance, and thereby, ecological outcomes (Agrawal 1994, Mwangi 2007). A smaller set of authors postulates a U-shaped relationship between inequality and successful collective action.

The first set of authors builds on Mancur Olson's (1965) insights regarding privileged groups to suggest that high levels of heterogeneity are likely to be associated with a greater likelihood of successful collective action (Hardin 1981). Collective action to protect resources or allocate them in a socially agreed-upon manner is likely to be associated with high startup costs, and if the group of users/managers is highly homogenous then decentralized efforts to meet these startup costs are likely to face significant obstacles. On the other hand, in an economically heterogeneous group, those with higher endowments may be willing to contribute the necessary startup costs either in exchange for a functioning collective institution, or for a proportionately higher share of benefits from the common-pool resource (Baland and Platteau 1999). And yet others have talked about how a sense of community despite heterogeneity among community members can become a part of the symbolic capital of the community, enabling better distribution of benefits (Cochran and Ray 2009).

A second group of authors focuses on the ways in which social and economic inequality among users and managers may make collective action around resource management difficult to sustain, and thereby, diminish the likelihood of ecologically sustainable resource governance outcomes. These authors focus on how inequalities in economic endowments and heterogeneities in the social context tend to result in unequal sharing of decision-making powers (Neupane 2003), low levels of trust (Kant 1998, Seabright 1993), and unequal allocation of benefits from a regulated common-pool resource (Moore 1993). Socio-political and economic inequalities, the argument goes, likely generate social resentments and disincentives for the rich to contribute to collective action. In turn, these resentments and disincentives make it difficult to govern the

commons effectively, leading to a vicious circle of widespread free-riding, over-harvesting, and unsustainable environmental outcomes. Scholars of gender and those concerned with the political ecology of resource governance focus especially on the negative effects of gender-based social heterogeneity and inequality on resource governance outcomes (Bandiaky 2008, Cleaver 2002, Moore 1993, Sikor and Lund 2010), but also disfavor institutions that produce inequitable outcomes even if such outcomes are at times associated with environmentally positive governance outcomes (Agarwal 2001).

Molinas (1998), in contrast to those who have identified a monotonic relationship between socioeconomic heterogeneity and collective action around common pool resources, suggests on the basis of an econometric analysis of 104 local organizations in Paraguay that the relationship is nonlinear. Low and high levels of inequalities are associated with lower likelihood of cooperation, and medium levels associated with higher levels of performance. Under low levels of inequalities, there are few who have the capacity to assume the costs of collective action. When inequalities are too high they may generate resentments or force outmigration – each of which prevents cooperation.

However these generalizations about the relationship between heterogeneity and collective action and effective regulation of common-pool resources are complicated by empirical findings that do not conform, and additional theoretical considerations that may account for divergent outcomes.

According to some, economic heterogeneities in the social context can undermine the likelihood of initiation of self-organized collective action as well (Mukhopadhyay 2004). Those who are better off may well be able to gain their needs from private

resources and the poor may not have sufficient resources to undertake collective action. On the other hand, some authors have argued that heterogeneities in interests and endowments are crucial to the maintenance of cooperation. Quiggin (1993), for example, argues that complementarities stemming from heterogeneities promote cooperative management of resources. Jodha's studies of commons in semi-arid parts of India suggests that successful collective action institutions to protect the commons during the colonial and precolonial period were founded on coercive feudal political-economic relations that denied access to poorer, marginal rural households (Jodha 1985). In a recent paper, Alix-Garcia (2008) similarly argues that heterogeneities among users are associated with positive outcomes because the poor do not gain benefits from commons.

Other scholars have focused on the potentially perverse effects of steps to increase equality. Examining logging contracts between communities and corporations in Indonesia, Engel et al. (2006) suggest that efforts to improve the bargaining position of communities led to increase in the area logged: greater equality in this study leads to worsened environmental outcomes. McPeak (2003) examines economic heterogeneities among users in relation to spatial heterogeneities in resource distribution, and argues that efforts to improve resource management by focusing simply on reductions in user heterogeneities without attention to spatial heterogeneities of resources are likely to fail in their objectives.

The above schematic review of existing evidence on the relationship between different forms of inequalities and ecological outcomes suggests on the one hand that different scholars focus on wealth inequality as a more durable indicator of economic inequalities (as opposed to income inequality), and also that there are substantial gaps in

what is known about important aspects of the relationship between inequality and resource governance outcomes. Despite some efforts to study the relationship between equality and sustainability more rigorously through systematic observation and careful theoretical development, existing studies are typically based on a single or a few cases drawn from a single country. Despite their ambiguous conclusions in the aggregate, one of the central inferences to be derived from them is the importance of institutions in shaping resource governance outcomes as they are influenced by inequalities. Indeed, most of the causal mechanisms identified in the above studies on inequalities and resource-related outcomes are built around how heterogeneities and inequalities have an effect on collective action and institutions – and through institutions on how resources are managed and ecological outcomes produced.

THE ROLE OF LOCAL GOVERNANCE

Previous research has also shown that local governance institutions play a critical role in explaining variations in forest conditions (Agrawal and Yadama, 1997; Gibson et al 2000; Geist and Lambin 2001; Agrawal and Ostrom 2001; Gibson, Williams, and Ostrom, 2005; Andersson and Gibson, 2007). Agrawal and Yadama (1997) suggest that local institutions mediate the influence of exogenous drivers of forest governance outcomes such as demographic and market pressures. Extending Agrawal and Yadama's argument to the relationship between socioeconomic inequalities and ecological sustainability, we argue that effects of social, economic, and or political inequalities on ecological outcomes are moderated by local institutional arrangements. In other words, the influence of socioeconomic inequalities on the environment depends on the nature

and effectiveness of local governance institutions because such institutions may dampen, enhance, or refract the effects of socioeconomic factors related to equality.

Indeed, local institutions may not only alter forest-related outcomes but may also modify the existing socioeconomic context. We argue that the role played by local institutions is often more dynamic than just a unidirectional influence of socioeconomic inequalities on nature: local institutions may simultaneously respond to *and* affect socioeconomic and biophysical factors in the local context. The diagram below illustrates the suggested relationships among the three groups of variables. It also forms the basis for the ensuing empirical analyses.

[Figure 1 here]

QUALITATIVE CASE STUDIES

In the next section we describe four real-world examples of the role played by local institutional arrangements in mediating the effects of inequality on forest governance outcomes. All data reported in these examples are drawn from the IFRI data base (IFRI 2008) and consist of qualitative estimates derived from participatory appraisal exercises with key informants at the community level, as detailed by the IFRI research protocol (Ostrom et al., 2004).

The descriptive analyses compare two forest-dependent communities in the middle-hills of Nepal and another two communities in the Chiquitanía region of Bolivia. We selected these four communities to ground our analysis of the role of local institutions and to explore the relationship between inequality, institutions and environmental change. The primary purpose of the comparative analysis is to explore and illustrate the potentially moderating role of institutions in four diverse, real-world cases. The findings

from this qualitative exploration will inform the construction of our main research hypothesis.

For this qualitative analysis, we selected two Nepali communities that were as similar as possible as far as their biophysical characteristics as well as their socioeconomic attributes, but not in the way they had organized their local institutions for forest management. To contrast the first comparison, we then analyze two Bolivian communities that are similar in terms of their biophysical and institutional contexts but differ with regards to the observed socioeconomic inequalities. Through this purposive selection, our qualitative comparison seeks to unpack the meaning of varying local institutional arrangements and socioeconomic inequalities in four concrete field settings.

Dhanamane Community Forest and Nehit National Forest of Ilam district, Nepal

Through the Forest Act of 1993 and the Forest Regulations of 1995, rural communities in Nepal have the right to form Community Forest User Groups (CFUG). These are self-governing groups with rights to acquire, sell, or transfer forest products for forests that grow within the limits of their titled community land. According to a 2004 government report, more than one million hectares of forestlands had at the time been handed over to about 13,000 CFUGs (CFD, 2004). Our comparative case analysis focuses on the experiences of two forest communities in the Ilam district of the Middle Hills. We draw these descriptions from fieldwork conducted in 1997 and 2003 by members of the International Forest Resources and Institutions (IFRI) research network.

In the Ilam district in the middle hills of Nepal, the community forestry program has been implemented since 1992, and as of 2004, a total of 170 CFUGs were carrying

out forestry activities throughout the district. Here, we describe the experiences of two of these communities: Dhanamane and Nehit.

The Dhanamane Community Forest, which the government handed over to the community in 1993, covers an area of 55 ha. The major tree species of this forest include *Schima wallichii*, *Castanopsis indica*, and *Elaeocarpus robustus*. The community is heterogeneous in terms of ethnicity, as groups of Brahmin, Chhetri, Rai, Limbu, Newar, Kami, Damai and Gurung live in Dhanamane.

Nehit forest is a government forest covering an area of 125 ha. This is a mixed natural forest and includes *Shorea robusta*, *Schima wallichii*, *Syzygium cumini*, and *Castanopsis sp.* as the major trees species. Local people living nearby the forest are using this forest in traditional ways to satisfy their basic needs. These users have no *de jure* forest property rights to this forest, but approximately 70 individuals from Nehit are using this forest to meet their subsistence needs. The District Forest Office (DFO) who has the authority of protecting and managing the forest allows this to happen.

Most households in both communities are entirely dependent on agriculture for their livelihoods, and depend on the forest for firewood, timber, grass, leaf litter, and agriculture implements etc. The main forest products harvested in both cases are fuel wood, grass, tree fodder, bedding material, leaf litter and timber. Almost all users in both communities have their own farmland, where they cultivate a mix of ginger and broom grass as the predominating the cash crops. Minority landless households either cultivate as tenant or are engaged in wage earning. The observations on the internal socioeconomic attributes of the two communities are practically identical: members of both perceive

high internal inequalities regarding economic asset endowments. According to user group perceptions, about 40 percent of each group is considered to be neither rich nor poor.

The two communities could not differ more, however, when it comes to the organization of their forest activities. In the case of the Nehit, there are no locally enforced rules that regulate the harvesting of forest products. Nehit forest users collect the products whenever and in whatever quantities they need. Standing timber is used for firewood, not fallen and dry branches. In contrast, in Dhanamane the community members have self-organized to develop rules to govern the community's use of forest resources. These institutional arrangements severely restrict the number of mature trees that may be harvested. Although there are some harvestable trees for timber and users have the right to harvest as per their management plan, the user group has not harvested any trees for the last six years. The secretary of the CFUG pointed out the reason: transportation of harvested logs is very expensive and therefore not profitable. The community institutions allow for the harvesting of grasses, tree fodder and leaf litter throughout the year. The community organization in Dhanamane that is in charge of enforcing the local institutions is dominated by middle class people, but two of its members come from the poorest segments of the community.

The local institutions in Dhanamane also seek to alleviate intra-group differences in economic opportunity. For one community asset—a cardamom plantation in the community forest—poor households benefit more from the products than do wealthier households because the poorer households have been given priority to choose their sites for cultivation. No such equality-enhancing rules exist in Nehit.

The overtime comparisons of changing forest conditions suggest that during the 1997-2003 period, the forest in Dhanamane was regenerating, showing significant increases in basal area estimates, while the forest used by the Nehit community seems to be degrading, especially in terms of total forest area and the number of saplings in its forest areas.

What factors help explain these differences? Because of the similarities in both communities' social and economic inequalities, these factors by themselves do not provide a strong explanation of the observed forest outcomes. A more plausible explanation is related to the ways in which the two communities' have responded to these inequalities—the local institutional response to inequality. To further develop the hypothesis that local institutional responses to inequality shape forest outcomes, we now turn to a comparison of two forest communities that share similar formal forest property rights but differ with regards to the socioeconomic inequalities within and between user groups in each community. Both of these communities are located in the tropical lowlands of Bolivia.

San Lorenzoma and San Juancito in the Chiquitanía region of Bolivia

The tropical lowland of Bolivia is a vast geographical area with diverse ecological, ethnic, and socioeconomic characteristics. Despite this diversity, lowland smallholder farmers share many of the predominant realities of small scale, subsistence agriculture found in other parts of tropical Latin America. Rural lowland communities rely on forests to satisfy essential subsistence needs. Forests provide products such as fuel wood, 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—

relies on firewood as the 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 (FAO 1988). Members of a typical family farm in the lowlands practice slash-and-burn agriculture to produce mainly maize, rice, and yucca. Farmers who are better off economically tend to hold larger land areas and clear forests for pastures to graze cattle. A common livelihood strategy for small-scale farmers in the Bolivian lowlands is to produce enough crops to satisfy two primary objectives: to produce enough food crops to feed their families; and to produce enough excess crops to sell these for a profit, which is then used for the family's nonfood needs such as school fees and healthcare items (Thiele 1995). Once the basic livelihood objectives are met, households typically invest the residual in alternative activities that yield the highest possible return for their scarcest resources, which is often cash and family labor (Davies et al. 2000).

In an effort to increase rural populations' benefits from forest management, the Bolivian government introduced new legislation in 1996, redistributing rights to considerable forest resources among the country's multiple resource users. For the first time in the country's modern history, smallholder farmers, and indigenous peoples gained the possibility of accessing formal management rights to forest resources.

In the ensuing comparative analysis, we examine more closely the experiences of San Lorenzoma and Santa Ana—two forest-dependent communities that were both

granted formal forest property rights in 2000. The analysis draws upon IFRI research conducted in the two sites in 2001 and again in 2005.¹

Members of both communities depend on forests for their livelihoods and harvest fuel wood, animal fodder, medicinal plants, grass for roofing, poles for fencing, and logs for construction. All households in both communities have farmland where they grow maize and other crops for subsistence. The distribution of land holdings in the two communities is relatively similar, but we observe different levels of intra-community economic inequalities: Economic inequality is relatively greater among members of San Juancito compared to San Lorenzoma residents, as explained in more detail below. All members of both communities meet their subsistence needs through their own household-based agricultural production, but some households in one of the communities have members who receive off-farm incomes, making those households better off economically.

In San Lorenzoma, our discussion with key informants and community members suggest only small internal differences in levels of wealth. The members perceive that all community members fall into the category of “neither rich nor poor”. The local institutional arrangements for forest management dictate that all men participate in forestry activities. In return for their efforts, resident families receive an equal share of the income from timber sales. The first year that the community harvested timber with government logging permits was in 2000. The sale of timber yielded a net income of an average of US\$320 per family. Only one of these families had income related to forestry activities previous to obtaining the community logging permits. The institutional arrangement that granted all community households equal opportunity to logging income

¹ This brief analysis draws on data used in Andersson (2004) and Andersson and Pacheco (2006).

is widely supported by community members and helps to explain the community's strong collective commitment to forest management activities.

In San Juancito, the internal socioeconomic inequalities are in stark contrast to those observed in San Lorenzoma. Community members perceive that there are big internal differences between members' level of wealth and only half the community members are perceived to be in the "neither rich, nor poor" category. In 2000, the community logged one management unit of their forest and received a total income of USD \$6000—a total amount that is slightly higher than that of San Lorenzoma, but after dividing it between forty eight families, it resulted in a much lower per-family average income in Santa Ana, \$125 per household. In the case of Santa Ana, it is important to note that previous to acquiring legal rights, forest management activities were not organized at the community level, but were instead carried out by a subgroup of six relatively rich individuals. These individuals estimated their average incomes from these formally illegal forestry activities to about US\$400 per family per year.

Under the new regime, it is still these six, better-off individuals who do the lion's share of the forest management work, but they now receive a substantially smaller pay since the income is now shared equally between all community members. These individuals are responsible for the planning, negotiating, and filing the necessary paperwork with the governmental authorities as well as handling the contacts with buyers. After the first year's harvest, the result was quite disappointing to these individuals as their personal income was lower than they expected. As a result, community-organized forest management completely stopped in San Juancito, but observations during a second visit to the community in 2005 indicated that sporadic and

uncoordinated timber harvesting by a few select individuals, without formal government permits—the way timber harvesting was done before 1996—had again become the normal way of using forest resources (Andersson and Pacheco, 2006).

It seems like the institutional arrangements in San Juancito have failed to provide the necessary incentives for the forestry leaders in the community to continue investing in forest management activities. The institutions failed to provide rewards for those community members who did most of the work, which jeopardized the collective action related to forest management. The arrangement diluted the benefits to the entire community, regardless of the contributions made to the forest management. This made collective action very costly for the six community forestry leaders. The ineffectiveness of the institutions to address these equality issues seems to have produced a successive erosion of the institutions for forest management.

Despite the observed differences in intra-community inequalities and local institutional arrangements, we do not detect any differences in outcomes with regards to the changing forest conditions in the two communities. This result is likely to be related to the large size of the forest lands that both communities control. Although the current harvesting patterns in San Juancito—characterized by uncoordinated and unordered timber felling—seem unsustainable, our research was unable to document the extent to which this had significant effects on forest outcomes. The comparative analysis suggests that inequality by itself does not always cause deterioration or improvements to the resource: The relationship between inequality and resource outcomes seems more complex.

The two comparisons illustrate the importance of local institutional arrangements as an important intervening variable in explaining how inequality affects forest governance outcomes. One implication from these comparisons is that future analyses of the effects of inequality on environmental change should recognize the crucial moderating role of local institutional arrangements. More specifically, the qualitative comparisons suggest that the ways in which inequality affects forest outcomes *depend* on the organization of forest users and their institutional arrangements for managing and monitoring forests, commercializing products, and distributing the costs and benefits associated with these activities. More formally stated, we hypothesize that the effect of economic inequalities on forest outcomes depends on the strength of local institutional arrangements for collective forestry activities. We will test this core hypothesis in the next section using multivariate regression techniques for a large number of field observations.

QUANTITATIVE ANALYSIS

The data for our large-N analysis were collected during fieldwork conducted between 1994-2002 by researchers affiliated with the Collaborative Research Centers (CRCs) of the International Forestry Resources and Institutions (IFRI) in India, Nepal, Kenya, Uganda, Bolivia and Mexico. The data set focuses on the attributes of 228 forest user groups who do not own but have some *de facto* usufruct and managerial rights to forests, and who sometimes share their forest use with other user groups. The rationale for focusing our analysis on user groups who have similar formal property rights is to

take into account the likely influence of property rights regimes on forest governance outcomes.

According to the IFRI research protocols, a forest user group is defined as the set of people who share the same rights and duties to access and use products from the forest(s). A forest, according to IFRI's operational definition, is an area of at least 0.5 hectares with woody vegetation. In any one IFRI site there may be several user groups using multiple forests. Because we are interested in inequality within and between user groups, we use the user group as our primary unit of analysis in this paper (see <http://www.umich.edu/~ifri>). Figure 2 shows how our observations are distributed across the selected countries.

[Figure 2 here]

Variables

Our quantitative analysis tests the effects of economic inequalities and local institutional arrangements on forest condition outcomes. “Relative forest condition,” our first dependent variable, was calculated by averaging the scores of three ordinal measures that correspond to all forests used by each user group: (i) local foresters’ assessments of the density of forest vegetation; (ii) local foresters’ assessment of the forests’ biological diversity; and (iii) the user group’s opinion about the general condition of the forests they use as compared to other forests in the area. Our second dependent variable, called “overall relative forest condition” averages a total of five ordinal measures to calculate the variable. In addition to the three measures used for the calculation of the first dependent variable, this variable also includes measures of the local users’ perceived

over-time trend for (1) forest biomass and (2) biological diversity for each of the forests used by the user groups.

Our independent variables may be classified into three broad categories: (i) inequalities; (ii) local institutions, and (iii) control variables. Our selection of variables corresponding to these three different categories is based on the existing literature and theoretical expectations in writings on local resource management, particularly those related to forest governance (Agrawal 2001, Agrawal and Chhatre 2006). Because we draw our data from the database created by the International Forestry Resources and Institutions, we have the flexibility to select from among more than 800 variables on which the IFRI database includes information.

Taking our cues from the existing literature that focuses on differences in wealth as a key indicator of group heterogeneity and inequality, we focus our analysis on two different wealth-based measures of inequality. Although other ways of measuring inequality are also possible (eg. political inequality or social inequality), we focus on economic inequality – both because it has been identified as being strongly correlated with political inequality in rural settings (Baland et al. 2006), and because it is more likely to be based on respondents' knowledge of the actual asset ownership of different households rather than being based on subjective perceptions about political or social salience.

We distinguish between the effects of economic inequalities both within and between user groups, employing one proxy variable for each type of inequality. First, “intra-group inequality” measures whether group members perceive great differences in wealth within the user group. We ask respondents what proportion of people in their

group are neither rich nor poor (a measure of economic equality), and subtract that proportion from 1 to gain a measure of economic inequality. Our second measure of economic inequality, which we term “Inter-group inequality” considers differences between user groups in each IFRI research site that share the use of at least one forest. This is a continuous variable expressed as the difference in the proportion of wealthy members between user groups that share access to the same forest. Low values for this variable mean that user groups that share forest access have low inter-group inequality as they have about the same proportion of rich group members. We consider both these ways of measuring inequality because a relatively large literature suggests these two different forms of inequality are both potentially important in explaining resource outcomes, but also because it makes conceptual sense to distinguish between inter- vs. intra-group inequality – they are likely to produce different causal effects on outcomes (Williams 1998). Inter-group inequality may be more difficult to manage through behavioral norms and can more easily generate conflicts between groups (Baland et al. 2006).

Local institutions represent the second main category of causal variables, and have been identified in particular by scholars of commons such as Ostrom (1990) as being critically important in shaping resource outcomes. Because we are interested in how inequality and local institutional arrangements affect the condition of forests, we focus on institutional variables that directly affect forest use. Our “Collective Action Index” is a measure of *de facto* arrangements for forest governance. We calculated the index by adding five binary variables indicating whether users (i) organize forest conservation activities; (ii) create rules for management; (iii) undertake forest

improvement activities; (iv) maintain records of rule violations and sanctions; and (v) enforce rules that a local forestry expert considers to be adequate for achieving sustainable forest use. Our choice of these variables is again based on a substantial literature on the commons that has highlighted them as being theoretically important. We applied equal weights to all five components. Higher values of the variable represent stronger and more substantive institutional shaping of forest activities.

Finally, we control for the effects of a number of factors that have been regularly cited in the commons literature as influencing forest conditions. These variables characterize the socioeconomic and biophysical contexts in which the local user groups carry out their forestry activities and include demographic characteristics (number of group members, number of other groups that the user group shares forest access with, the age of the user group), socioeconomic development (literacy rate), and several biophysical attributes of the locality (forest size, topography, commercial value of forest, and distance from nearest town). Table 1 shows how the dependent and independent and control variables were operationalized, and table 2 lists the descriptive statistics for the variables.

[Tables 1 and 2 here]

RESULTS

The empirical analysis utilizes ordinary least squares (OLS) regression with robust errors. We carried out separate analyses for the two dependent variables in which we are interested. The main reason to use two different dependent variables that are proxies for the same underlying variable – forest condition – is to examine the extent to which the explanatory variables included in the models are statistically significant and

have consistent effects in both models. If both models produce consistent results, it strengthens the robustness of the empirical analysis.

The results from the two regression models are presented in Table 3. We list the regression coefficients with the robust standard errors in parentheses. A series of diagnostic tests on the results suggest that our models are well-specified.²

Substantively, our results lend substantial support for the hypothesis that intergroup inequality and the interaction between institutions and inequality are important to explain variations in the conditions of forests used by rural communities. In the first model, a ten percent increase in inter-group inequality (the difference between the proportions of rich people in user groups that share access to local forests) corresponds to an 11.2 percent decline in the relative forest condition measure (Model 1; $p < 0.01$). In the second model, the negative effect of inter-group inequality on overall forest condition is statistically significant ($p < 0.01$) and a ten-percent increase in intergroup inequality corresponds to a 4.3 percent decline in overall forest condition.

[Table 3 here]

In accordance with a substantial literature on intra-group economic inequality, our analysis also finds a statistically significant association between our measure of intra-group inequality and forest condition in both models (although the statistical significance

² The F-statistics for the two models are 11.22 and 12.39, respectively, with $p < 0.00001$ for each. The residuals for both models are normally distributed. To check for heteroskedasticity, we used the Breusch-Pagan test, and to test for the possibility of non-linearities the Ramsay Regression Specification Error test. We also examined whether individual observations have a strong influence by using the Cook's Distance and Leverage statistics. Finally, we calculated the Variance Inflation Factor for each variable to check for multicollinearity. None of these diagnostic tests indicated a violation of the OLS assumptions.

of the association is smaller in model 2). The magnitude of this negative effect is considerably smaller than for inter-group inequality: a ten percent increase in intra-group inequality corresponds to a decrease in forest conditions of 2.4 percent and 0.9 percent respectively. Hence, economic inequality between groups--more so than *within* groups--seems to pose a more serious threat to sustainable forest management. Overall, the strong negative association between forest condition and both measures of economic inequality in both models lends weight to the larger body of scholarship that has argued for a negative effect of economic inequality on resource governance outcomes.³

We find mixed evidence with regards to the direct effects of institutional arrangements on forest conditions, when controlling for economic inequalities. Local institutional arrangements have a statistically significant direct effect on overall forest conditions (Model 2), but we do not detect a statistically significant influence on relative forest conditions (Model 1). Part of the reason may have to do with the inclusion of changes in forest conditions in the measure of overall forest conditions. Where local collective action is occurring in a large number of dimensions--reflecting local efforts to organize and regulate a variety of the potential human influences on forests--the likelihood of improvements in forest conditions is higher.

Interestingly, we find that local institutional arrangements have a statistically significant and strong *indirect* effect on both measures of forest conditions. This is evident in the finding that the two-way interaction term (inter-group inequality multiplied

³ We also tested the possibility of nonlinear correlations by including quadratic terms of the two inequality variables in the both models, but these terms were not statistically significant.

by the collective action index) is statistically significant in both models.⁴ This means that the effect of inter-group inequality on forest conditions depends on the strength of local collective action institutions. Specifically, the negative signs for inter-group inequality and the positive signs for the interaction terms in both models suggest that the negative relationship between inter-group inequality and forest outcomes is tempered in the presence of strong collective action. For each ordinal score increase of the index (for example, from 0 to 1 or from 4 to 5), the negative slope of the regression line of relative forest conditions on inter-group inequality is predicted to decrease by 0.267 units in Model 1 and by 0.119 units in Model 2. We conclude that the better the performance of the local institutions for collective action, the more institutions dampen the negative effect of inter-group inequality on forest conditions.

The analysis also shows some interesting results concerning the effects of several control variables. On the one hand, the control variables “age of user group”, “topography”, and “Commercial value of forests” all have the predicted effects on forest outcomes, and have statistically significant coefficients in both models ($p < 0.05$). But contrary to what several studies have found, we detect no significant influence of group members’ literacy rates on forest condition. A possible explanation of this finding is that the level and variability of literacy rate in our sample are quite low (see table 2).

⁴ We did not find a statistically significant coefficient for the interaction between intra-group economic inequality and collective action. We believe this result is related to the relatively small effect that intra-group inequality has on forest conditions (both model 1 and 2) and its weaker statistical significance (model 2).

DISCUSSION

This paper has sought to contribute to the literature on community-based resource management and its relationship with economic inequalities. Although this theme has found some recent attention in the larger literature on the commons (see Naidu 2009 and Wilshusen 2009 for recent examples), there are several aspects of the relationships between inequalities, local institutions, and resource outcomes that are not well understood. In particular, our analysis draws attention to two important issues. First, it suggests that inequalities can be measured in a number of different ways. In the literature on the subject, this point is well recognized – both in the theoretical and empirical contributions, even if the effects of different measures of inequality are not tested systematically against relevant outcomes of interest. In our analysis, we use two different measures of economic inequality – the first concerns intra-group inequality, and the second focuses on inter-group inequality. We find that both these ways of looking at economic inequality have statistically significant and negative impacts on outcomes.

In light of the divergent conclusions in the commons literature on inequality, the analysis and findings of this paper are particularly interesting. Although some scholars have suggested that inequality produces a negative impact on outcomes and others have identified a positive relationship between inequality and governance outcomes – particularly those operating from theoretical principles related to explanations of collective action, our results suggest that both inter- and intra-group inequalities have consistently negative effects on resources.

The second important issue that emerge from the analysis is that we find empirical support for our hypothesis that local institutional arrangements moderate the

effects of inter-group inequalities on forest outcomes. The negative effects of economic inequalities between groups are moderated by strong local institutions as measured by the strength of collective action for different joint activities among users. In both models that we examined, the signs for inter-group inequality are negative and statistically significant. In both models, the interaction term between inter-group inequality collective action is positive and statistically significant. These results suggest that when local forest users are well organized and have effective rule-making, monitoring and enforcement systems in place, they systematically reduce the detrimental effects that economic inequality between groups have on forest conditions.

We should also sound a note of methodological caution: The cases on which we have based our analysis are not selected in a representative manner. Although the database created by the scholars who are part of the International Forestry Resources and Institutions network is perhaps the most comprehensive database of its kind, the data that has been collected was not based on a random selection of relevant cases from the full set of forest commons in the studied countries. The effects of selection bias in our sample are partly redressed by the fact that the selection of cases occurred without consideration of the outcomes on the cases. We have also attempted to address these effects by examining cases in qualitative detail to understand better how inequality, collective action, and forest outcomes are related to each other in these specific cases. The consistency between the case findings and the findings of the quantitative analysis make for greater reliability of our results. In the future, another way to address this shortcoming in terms of selection bias would be to revisit the same communities. As longitudinal data becomes available for these sites, the validity of the findings can be improved.

CONCLUSION

The scholarship on collective management of natural resources has identified different ways in which economic inequalities can influence resource governance outcomes – negatively, but under some conditions, also potentially positively. This paper uses a multi-country, multi-site dataset in combination with information from the purposive comparison of cases to examine how two distinctive measures of local economic inequalities affect forest commons outcomes.

Although this subject is of substantial general interest, few studies have examined the relationship between inequality and commons outcomes based on hypotheses (derived from comparative case analysis) tested with systematically collected data from several different countries. Taking advantage of a unique dataset assembled over the past 18 years by researchers belonging to the International Forestry Resources and Institutions network, we use evidence from six countries to investigate how inequalities affect forest outcomes.

Our findings are twofold: both intra-group and inter-group inequalities have consistent and statistically significant negative effects on forest conditions; and, strong collective action and institutions at the local level moderate the negative impacts of inter-group inequalities. Conceptually, our results underline the importance of testing the relationship between inequality and forest outcomes using different measures for assessing forest outcomes and operationalizing inequality. This strategy is similar to that followed in other recent writings (e.g. Naidu 2009) that rely on different ways of

measuring inequalities. However, we find that our results point consistently to the negative impacts of inequality on forest condition outcomes.

Our findings have substantial policy relevance, particularly in the context of ongoing decentralization reforms, and recent efforts to create new institutional arrangements through which to reduce emissions from deforestation and forest degradation in developing countries (REDD+). Our results suggest that if governments fail to attend to local economic inequalities, they are more likely to find negative resource outcomes. Similarly, if local institutions are weak and there is insufficient collective agreement or action, forest conditions and changes in forest conditions are both likely to be affected negatively. Although our analysis does not identify specific causal mechanisms through which inter and intra-group inequalities translate into negative resource outcomes, they point to the urgent need to address economic inequalities to help improve resource outcomes.

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TABLES AND FIGURES

Figure 1: Relationships between the Three Categories of Variables

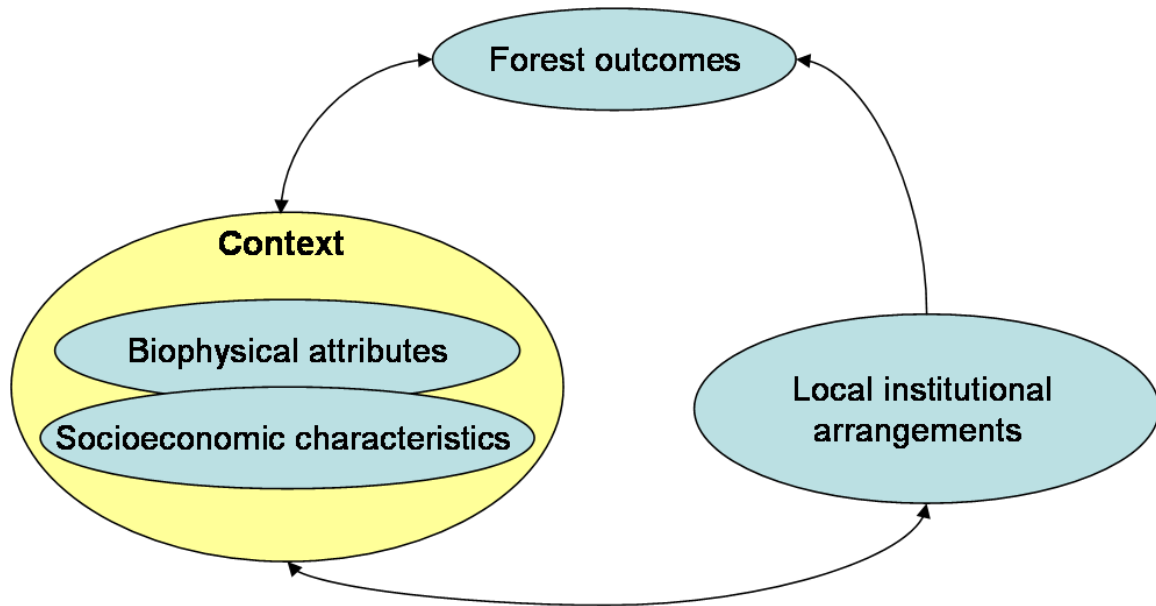


Figure 2: The location of the 228 user groups included in the analysis

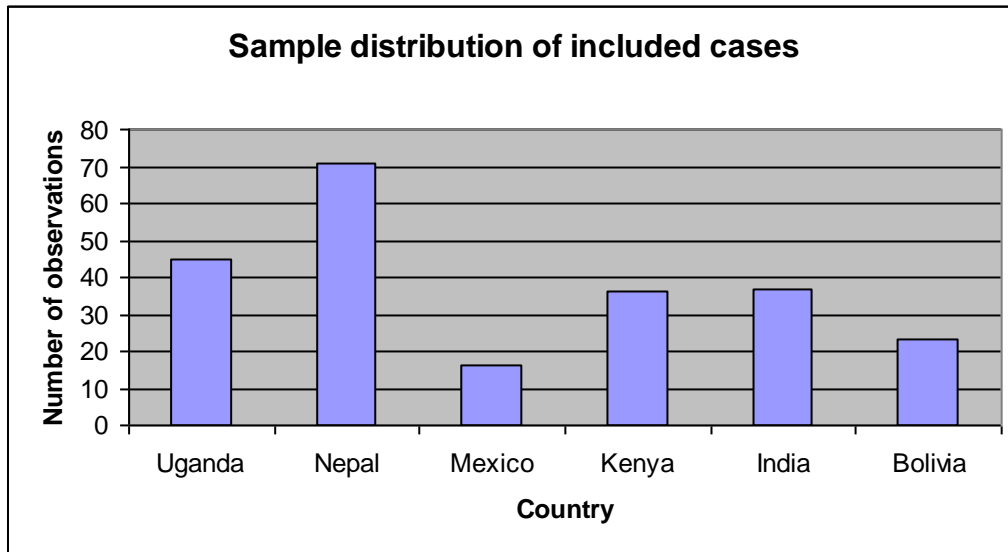


Table 1. Description of variables

<i>Variables</i>	<i>Description</i>
<u>Dependent Variables</u>	
Relative forest condition (DV1)	The average score of three ordinal measures (1-5): Local perceptions about (a) forest vegetation density; (b) biological diversity, and (c) the condition of the forest as compared to other forests in the area.
Overall, relative forest condition (DV2)	The average of five ordinal measures (1-5) of local perceptions about forest conditions: (a) biomass trend; (b) diversity trend; (c) relative density; (d) relative biological diversity, and (e) general condition of the forest as compared to other forests in the area.
<u>Independent Variables</u>	
Intra-group economic inequality	1 - Respondents' estimated proportion of user group members that are "neither wealthy nor poor"
Inter-group economic inequality	Continuous variable expressed as the difference between user groups with regards to the proportion of wealthy group members, expressed in percent.
Collective action index	An ordinal measure of collective action for forest governance calculated by adding five binary variables indicating whether users have (a) organized any forest conservation activities; (b) created any rules for management; (c) undertaken any forest improvement activities (d) users keep records of rule violations and sanctions, and (e) a local forester considers the rules that users actually follow are considered to be appropriate for conservation.
Age of user group	Number of years that the user group has existed
Literacy rate	Percentage of group members who have received basic primary education
Number user groups	Number of user groups sharing use of forests in the site
Forest size	Average size of the forest(s) used by the user group (hectares)
Topography	Average of the ordinal variables describing the topography of each forest used by the user group, ranging from very steep (5) to completely flat (1).

Commercial forest value	Average of the ordinal variable measuring the commercial value of all forests used by the user group
Distance from town	Number of minutes it takes members of the user group to walk during the dry season to the nearest urban settlement

Table 2. Descriptive Statistics

<i>Variables</i>	<i>n</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<u>Dependent Variables</u>					
Relative forest condition (DV1)	228	-0.134	0.560	-1.000	1.667
Overall, relative forest condition (DV2)	228	-0.167	0.540	-1.500	1.000
<u>Independent Variables</u>					
Intra-group economic inequality (proportion)	228	0.456	0.495	0.000	1.000
Inter-group economic inequality (cont)	228	0.125	0.111	0.000	0.710
Age of user group (years)	228	86.61	137.1	4.0	804
Literacy rate (proportion)	228	0.468	0.334	0.026	1.000
Number user groups (count)	228	2.327	1.520	1	6
Collective action index (ordinal)	228	2.698	1.314	0	5
Forest size (hectares)	228	2369	4922	0.500	44900
Topography (ordinal)	228	3.367	1.529	1	5
Commercial forest value (ordinal)	228	-0.481	0.948	-2	1
Distance from town (cont.)	228	28.32	40.26	0	360

Table 3. Ordinary Least Squares regression results: Coefficients listed with robust standard errors in parentheses.

Dependent Variables	Model 1:	Model 2:
	Relative	Overall
	Forest	Forest
Independent Variables	Condition	Condition
<u>Economic Inequality</u>		
Intra-group inequality	-0.474 (0.174)***	-0.190 (0.097)*
Inter-group inequality (a)	-2.230 (0.585)***	-1.069 (0.361)***
<u>Institutions</u>		
Collective action index (b)	0.039 (0.037)	0.116 (0.023)***
Interaction term (a * b)	0.267 (0.088)***	0.119 (0.050)**
<u>User characteristics</u>		
Age of user group	-0.001 (0.000)**	-0.001 (0.000)**
Literacy rate	-0.060 (0.142)	-0.005 (0.087)
Number user groups	0.005 (0.043)	-0.027 (0.028)
<u>Biophysical attributes</u>		
Forest Size	0.000 (0.000)	0.000 (0.000)
Topography	0.091 (0.035)***	0.070 (0.023)***
Commercial forest value	0.424 (0.048)***	0.196 (0.032)***
Distance from town	-0.001 (0.001)	0.000 (0.000)
Constant	0.261 (0.250)	-0.252 (0.152)*
<hr/>		
Number of Observations	228	228
Adjusted R2	0.284	0.308
F	11.22	12.39
Prob > F	0.000	0.000
Variance Inflation Factor	1.55	1.55
Breusch-pagan test (p-value)	0.65	0.22
RESET (p-value)	0.11	0.25

* $p < 0.10$

** $p < 0.05$

*** $p < 0.01$