

**INEQUALITY AND INSTITUTIONS AS JOINT DRIVERS OF FOREST GOVERNANCE OUTCOMES:  
EVIDENCE FROM THE BOLIVIAN LOWLANDS**

by

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Inequality and Institutions as Joint Drivers of Forest Governance Outcomes: Evidence From the Bolivian Lowlands

Thesis directed by Prof. Krister Andersson

This dissertation investigates how (a) economic, land-based, and sociocultural heterogeneities among those who depend on the forest for their livelihoods, and (b) the institutions that govern how forest resources are managed, jointly shape forest governance outcomes. The first chapter introduces the overall argument of the dissertation, and outlines its structure. The second chapter presents a systematic review of relevant literature. The third chapter presents an analysis of county level data to test multiple hypotheses about the roles of income and land-based inequality in driving forest outcomes. I find that economic inequality and land inequality tend to adversely affect forest governance outcomes, as has been found in the literature. However, the Bolivian data also reveals a novel finding: titling appears to moderate the adverse effect of economic inequality on forest condition change. The fourth chapter assesses the different flavors of inequality and heterogeneity at the community level, through a comparative case study of two Bolivian lowlands communities. I make the case that while titling and economic inequality may have a mutually moderated effect, as found in the second chapter, the situation is actually more complex; titling is not a panacea for good forest governance. In particular, I argue that network-based inequality, wherein actors without strong connections to powerful actors receive fewer benefits and have much less decision-making authority than others, is a proximate driver of forest governance outcomes. In the fifth chapter, institutional design is assessed as a driver of forest governance outcomes, and moreover as a likely mitigating factor for network-based

inequality. Several specific hypotheses are posited from this analysis. The hypotheses generated from the comparative institutional analysis of the two Bolivian communities are then tested using municipal data from Bolivia. I find that institutional redundancy and multiple loci of governance in forests are associated with better forest outcomes. However, I fail to find support for the hypothesis that institutional redundancy and polycentric governance bolster the *de facto* enforcement of *de jure* property rights; further directions for study are therefore suggested.

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## Chapter 1 – Introduction

1  
2

3 Keeping forests standing and in good condition is of interest to a variety of actors including  
4 governments, NGOs, the international community, private firms, and – perhaps most importantly  
5 – the millions of people who depend directly and indirectly on the resources and environmental  
6 services that forests provide. To date, there have been severely mixed results in community  
7 forest management schemes with respect to multiple outcome variables (Mayers and Vermeulen  
8 2002; Tokede et al. 2005; Ravikumar et al. 2012). In spite of a pronounced and widespread  
9 interest in forest conservation strategies, and myriad efforts to sustainably scale up forest  
10 conservation strategies that are effective, efficient, and equitable, success has been both sporadic  
11 and elusive. Many factors are thought to drive outcomes in forest systems. Institutions – the  
12 formal and informal rules that constrain and direct actors’ behavior – and the incentives that they  
13 produce interact with and mediate economic, social, and demographic factors in complex ways  
14 to produce the outcomes that we observe in forest systems. The purpose of this dissertation is to  
15 investigate empirically, using data from the Bolivian lowlands, the ways in which these factors –  
16 particularly those for which the scholarship has produced mixed predictions – work to drive  
17 forest governance outcomes.

18 Through this dissertation, I make the argument that the local governance of forest resources is  
19 strongly influenced by network-based inequality, which is based on other forms of heterogeneity  
20 and inequality, but can also be mediated by institutions at varying scales. I make this argument in  
21 order to advance policy-relevant understanding of forest governance and to promote further  
22 study of these processes that will move us towards a more complete understanding of these  
23 complex coupled natural-human systems. In spite of the large body of scholarship on these

24 subjects, the dynamics of these systems is still poorly understood, and understanding these  
25 systems more fully is critical for international climate policy and the livelihoods of the hundreds  
26 of millions of people who live in and depend on tropical forest resources. The argument, which is  
27 shown empirically through the analyses presented in later chapters, is now described in some  
28 more detail.

## **1.1 Inequality and Heterogeneity**

In the context of forest governance, inequality and heterogeneity of multiple types have been shown to affect outcomes by hindering collective action<sup>1</sup>. The terms “inequality” and “heterogeneity” can be distinguished from each other, and moreover neither is monolithic (see Chapter 2 for a review of relevant literature).

### **1.1.1 Economic Inequality**

Economic inequality typically refers to commonly measured factors like income and expenditure, along with monetary wealth. However, other types of inequality, such as differential possession of land titles and tenure and the possession of assets that do not generate monetary benefits but are important for subsistence livelihoods, can be key drivers of forest governance outcomes as well. Collective action theory, a dominant paradigm in the study of social-ecological systems and natural resource governance, suggests that inequality can preclude the development of social capital, and consequently hinder effective and equitable collective decision making in the local governance of natural resources (Adhikari and Lovett 2006; Ostrom

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<sup>1</sup> Some research has shown a U-shaped relationship between economic inequality and certain forest governance outcomes (Bardhan and Dayton-Johnson 2002), while other scholars have actually posited that the relationship may work in the opposite direction altogether (Olson 1965), although this view has found little empirical support.

2000). Since the mechanism by which collective action may be compromised by economic inequality turns on social capital, it is reasonable to expect that where social capital is developed in one arena – such as conferring collective land titles to communities – the adverse effects of other types of inequality on forest governance outcomes may be lessened. The first empirical chapter tests hypotheses related to these concepts.

### **1.1.2 Heterogeneity**

Economic inequality has been characterized as a type of group heterogeneity, in that where there is economic inequality, there is a heterogeneous distribution of economic resources. Other types of heterogeneity also exist, and have been found to drive forest governance outcomes. These include ethno-linguistic heterogeneity and sociocultural heterogeneity (e.g. Agrawal 2001; see Chapter 2 for further treatment of the literature surrounding heterogeneity).

Heterogeneity, like economic inequality, is therefore not monolithic. Moreover, the term “heterogeneity” can be considered to subsume economic inequality. In spite of these distinctions and overlaps, the concepts are closely linked through the collective action framework.

Scholarship of the local governance of natural resources have suggested that non-economic heterogeneities among forest users can also compromise effective collective action and forest governance outcomes (Varughese and Ostrom 2001; Adhikari and Lovett 2006). For this reason, both concepts are considered within the scope of this study. Non-economic heterogeneities are treated as potential drivers of social network formation, in particular.

### **1.1.3 Local Networks and Network-based Inequality**

At the local level, it economic inequality – including inequality in land titles and non-monetary assets - alone does not fully explain variation in forest governance outcomes or collective action failures. I argue that local networks, and the network-based inequality that is embedded within them, are key proximate drivers of forest governance outcomes and collective action failures. Social networks of actors coalesce around a variety of group factors, including class, ethnicity, language, kinship, politics, shared goals, and ideas (Cote et al. 2009; Kumar et al. 2008). Environmental sociologists and others have argued that network-based inequality is a phenomenon wherein networks are used by elites to capture benefits and shift the costs of environmental degradation onto individuals that are not in their networks (Downey and Strife 2010; McDonald 2011). The second chapter of this dissertation uses a comparative case study to answer the question: how do local networks of actors form, how are they sustained, and do they indeed lead to such network-based inequality? The results of the comparative case study suggest that these networks, and the inequality embedded in them, is an important proximate driver of forest governance outcomes. I argue, moreover, that studying these networks is valuable because they explain the mechanisms of collective action failure better than economic inequality – even when construed broadly – on its own.

## **1.2 Institutions**

In this dissertation, I use Douglass North's definition of institutions: the formal and informal rules that constrain human behavior (North 1990). Institutions are distinct from organizations, which are some of the actors that operate in institutional spaces. Recent scholarship has shown that institutions are important mediators in the local governance of natural resources, and that good institutions, characterized by accountability, transparency, and legitimacy, can improve the performance of forest governance and moderate the adverse effects of other factors that may

compromise effective governance (Poteete and Ostrom 2004; Andersson and Agrawal 2011). However, there is no consensus in the literature surrounding exactly how these institutions should look, or what it takes to form them (Klooster 2000). A comprehensive answer to this question is outside the scope of this dissertation, or indeed any singular study at this time.

The final empirical analyses of this dissertation therefore examine the organizational structures of two Bolivian communities, and proffer several hypotheses about how multilevel and polycentric governance institutions may produce different forest governance outcomes. These hypotheses are tested at the county (*municipio*<sup>2</sup>) level. I argue that the presence of multiple overlapping organizations involved in forestry may provide additional channels for local people to assert *de facto* claims to *de jure* rights, but that the degree to which this is true may depend at the level at which these organizations operate. Local institutions may have more direct accountability to local people, whereas higher level organizations may instead provide opportunities for elites to further capture benefits and exclude local people from participation in forest governance processes.

### **1.3 Forest Governance Outcomes**

So far, forest governance outcomes have been discussed in the abstract. In reality, there are multiple forest governance outcomes that are of interest to various actors. These outcomes include, at a minimum, (1) forest condition change, (2) livelihood outcomes, and (3) equity outcomes. These outcomes overlap, and there may be both trade-offs and synergies between them depending on conditions (Chhatre and Agrawal 2009). In addition to these outcomes, some

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<sup>2</sup> In Bolivia, and also elsewhere in Latin America, the term *municipio* refers to an administrative sub-division that is analogous to counties in the United States, or British shire districts in the sense that they often include urban or semi-urban centers as well as surrounding areas that often encompass multiple land uses. Throughout this dissertation, *municipios* are translated as “counties” rather than “municipalities” because it better reflects the administrative subdivision level in the Anglophone world.

scholars consider institutional change to be an outcome in itself. For example, forest governance systems can gain legitimacy and accountability. In addition, these outcomes can be further decomposed. Forest condition can be construed in a number of different ways, with some stakeholders focusing on carbon, and others focusing on other ecosystem goods and services that forests provide. Livelihoods can also be measured in a variety of ways. Flows of monetary benefits are important and commonly applied measures of well-being with respect to livelihoods, but other factors – such as the ability to continue living a subsistence lifestyle with resilience against economic perturbations – is another conceivable measure. Ultimately, the context determines which measure is most appropriate.

Thus, the central questions that this dissertation asks are (1) what types of inequality and heterogeneity are most important as drivers of forest governance outcomes, (2) how do inequality and heterogeneity drive forest governance outcomes, and (3) how do institutions mediate these processes? Subsequent empirical analyses answer these questions.

#### **1.4 The Importance of Tropical Forests**

Forests and people are inextricable parts of a coupled system. It is impossible to manage forests – as spaces, ecosystems, objects of policy intervention, or even economic resources – without considering concurrently the people who own, live in, use, and depend on them. For the tens of millions of people who live in forests and depend directly on them for their livelihoods, and also for the billion or so people who live in poverty and directly harvest or purchase important forest products (Scherr et al. 2003), the sustained condition of tropical forest resources is essential. Moreover, there are reasons for others, even those who are less directly dependent on forest

resources<sup>3</sup>, to care about forest sustainability around the world, and to be concerned about current trends.

#### **1.4.1 Climate Change and Tropical Forests**

Anthropogenic greenhouse gas emissions threaten to destabilize the Earth's climate and produce a suite of impacts on humans and the environment itself. Human impacts are likely to include increases in the frequency and severity of floods, droughts, and other natural hazards rising sea levels; changes to average regional temperature and precipitation (IPCC 2007); increases in disease transmission that threaten human health (Patz et al. 2005); and damage to global infrastructure and agricultural systems (Lehman 1998) in different regions of the Earth (IPCC 2007). Other impacts may include habitat loss for species and extinctions (Thomas et al. 2004), changes in the phenology of species (Diamond et al. 2011), and changes in the spatial distribution of species (Seastedt et al. 2011). Overall, losses in biodiversity are likely to continue as the climate changes (IPCC 2007). While there is high uncertainty surrounding the specific impacts of anthropogenic climate change, there is a broad consensus that it will have undesirable consequences. There are moreover serious ethical concerns that arise from humans altering the climate (Hale and Grundy 2009; Kysar 2004; Dellink 2009).

Anthropogenic climate change is intimately linked with tropical forests in three related ways: (1) tropical forests are carbon sinks; (2) tropical forests are carbon stores; and (3) tropical forests are carbon sources.

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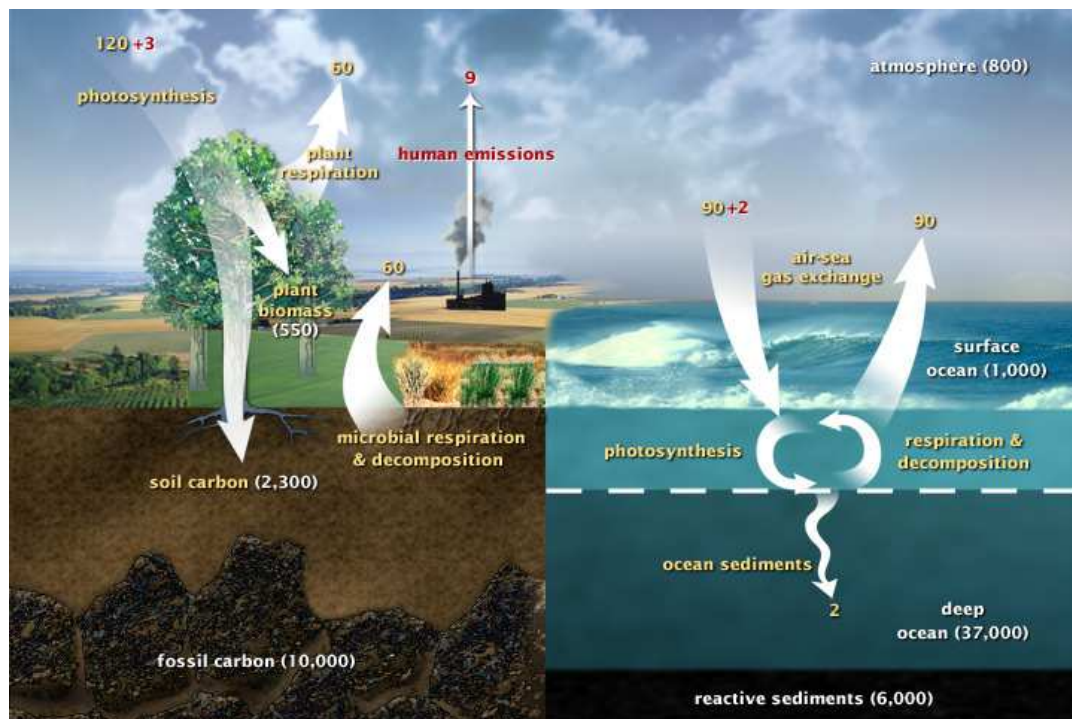
<sup>3</sup> All aerobically respiring organisms are of course directly dependent on oxygen, and tropical forests produce a non-trivial fraction of Earth's oxygen stock (Foley et al. 2005).



Tropical forests are key carbon sinks, continually incorporating atmospheric carbon through photosynthesis. Between 1990 and 2007, standing mature tropical forests were responsible for the uptake of  $1.19 \pm 0.41$  PgC/year, while forests that were in recovery from past deforestation and forest degradation absorbed  $1.64 \pm 0.52$  PgC/year (Pan et al. 2011). There is also evidence that as atmospheric carbon stocks increase due to human activities because, tropical forests can further increase their rate of carbon sequestration in response to the higher atmospheric concentrations, as well as disturbances that lead to continual regrowth (Lewis et al. 2009). While uncertainty surrounding these estimates is very high (Le Quéré et al. 2009), the consensus is that deforestation and forest degradation in the tropics contributes substantially to global anthropogenic carbon emissions, and that forest conservation and enhancing forest stocks can play a central role in mitigating climate change from anthropogenic greenhouse gas emissions.

Tropical forests are also important stores of carbon. Tropical forests store carbon above both in above-ground biomass and in their soils. Estimates of total tropical forest carbon exhibit very high uncertainty, but they tend to coalesce around 250 PgC (petagrams of carbon) (Scharlemann et al. 2010). Figure 1.1 shows a schematic of the global carbon cycle, putting these figures in perspective. The amount of carbon stored in tropical forests is roughly half of the carbon stored in all forests on Earth, one third of the carbon stored in the atmosphere, and a quarter of the carbon found in the shallow ocean (Falkowski 2000). Because so much carbon is stored in tropical forests, rapid tropical forest degradation can release carbon into the atmosphere. However, some carbon is stored in more recalcitrant forms in the soil, and is less likely to be released quickly as forests are degraded (Gibbs et al. 2007).

### **Figure 1.1 The Carbon Cycle**



Source: US DOE (Image in Public Domain). Arrows represent fluxes; white numbers represent carbon stores (PgC); yellow numbers represent flux amounts (PgC).

Finally, tropical forests are carbon sources. Tropical forests release carbon into the atmosphere through respiration every year, although they incorporate more through photosynthesis (Raich and Schlesinger 1992). On the other hand, stored carbon in tropical forests can be released rapidly when forests are destroyed or degraded. Tropical deforestation and degradation present a severe threat to atmospheric stability, contributing between 6 – 17% (van der Werf et al. 2009) of global anthropogenic carbon emissions, or roughly  $1.3 \pm 0.7$  PgC/year (Pan et al. 2011).

### 1.4.2 Environmental Services for the Global Community

Tropical forests provide a suite of environmental (or ecosystem) services apart from their role in mediating Earth's climate as carbon sinks. These services include hosting biodiversity, maintaining water supplies, controlling soil erosion, and facilitating the growth of valuable timber species and non-timber forest products (Xiao et al. 2000). Some of these services, such as

production of valuable timber, are easier to ascribe economic value to than others, such as beauty and cultural value. One attempt at such a valuation of tropical forests estimated that the total economic value of environmental services provided by tropical forests was roughly \$3.8 trillion per year (Costanza et al. 1997)<sup>4</sup>. While economic value is not the only type of value that tropical forests and other biomes have, it is useful to consider what their economic or monetary value might be lest they be ignored altogether in decision processes that weight economic value highly.

Some of the more intangible environmental services, such as the value that people around the world place on biodiversity in the tropics – or the mere existence of tropical forests - was excluded from the valuation of Costanza et al., although they certainly have a non-zero economic value; that is, there is some amount that people, in aggregate, are willing to pay in order to preserve biodiversity in the tropics. Other services have more obvious economic value but are also excluded from many attempts to value ecosystem services. These include compounds produced by tropical plants and microbes that may have pharmaceutical value and the tropical reservoir of genetic diversity (Mendelsohn and Balick 1995). These services are high in value, they provide benefits to people all over the world, and the costs associated with their loss through deforestation and forest degradation is consequently externalized and shifted to a large group of people (cite).

Apart from climate change, these environmental services have provided a strong incentive for OECD countries to invest in forest conservation in the tropics. In the discourse surrounding the REDD+ initiative (Reducing Emissions from Deforestation and Forest Degradation in

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<sup>4</sup> These are 1997 dollars, and moreover this estimate should be taken with a grain of salt given the number of assumptions required and the magnitude of the task of estimating the economic value of the world's tropical forests. The main point is that tropical forests are very valuable, and much of their value is not visible in the marketplace.

Developing Countries, ‘+’ Enhancing Forest Carbon Stocks), which the international community is in the process of developing and deploying (as of June 2013), these are referred to as ‘co-benefits’ to forest conservation (Angelsen 2009) alongside other human co-benefits like....

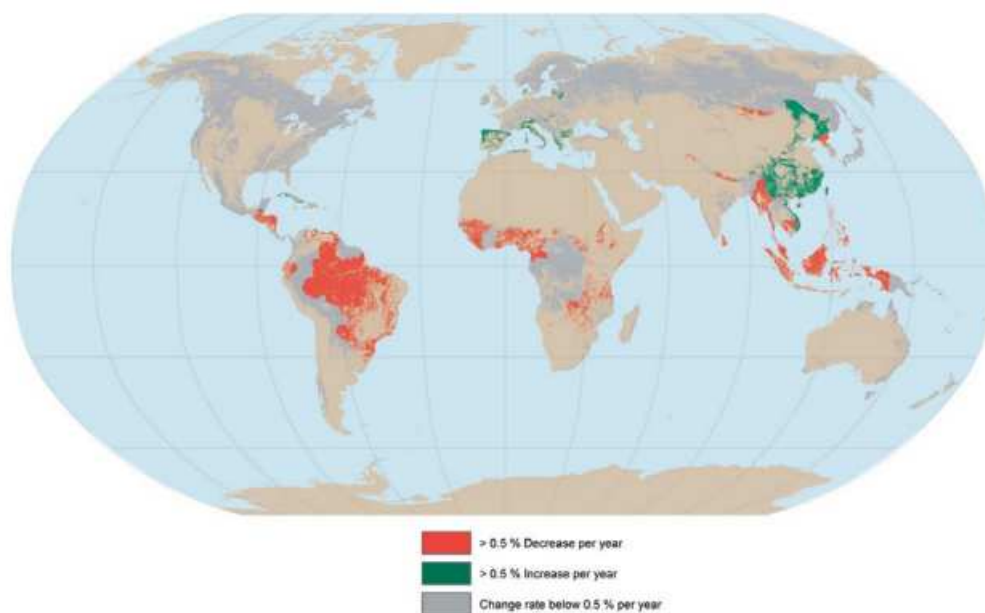
### **1.4.3 Poverty and Livelihoods**

Tropical forests are located primarily in the Global South, and the people who live in them are largely poor, have subsistence lifestyles, and, in many cases, belong to indigenous and other marginalized groups (FAO 2010). An estimated 300 million people live in and around forests, and around 1.6 billion people depend on forest resources for their livelihoods, including over 60 million indigenous people (Vedeld et al. 2007). For example, Figure 1.2 shows the distribution of global forests (including those outside of the tropics), and the rate of deforestation that they are experience.

### **Figure 1.2 – Global Deforestation Map<sup>5</sup>**

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<sup>5</sup> Adapted from Nabuurs et al. (2007)



**Figure 9.1:** Net change in forest area between 2000 and 2005  
Source: FAO, 2006a.

The tropical forests of the Amazon, the Congo Basin, and Southeast Asia all appear largely red and grey on the above map, showing the ubiquity of deforestation in the tropics. The trends in deforestation have changed somewhat since 2005, but tropical deforestation and forest degradation persists in general.

People who live in these threatened forests depend on a suite of forest products for their livelihoods, including building materials, food, and medicine (Donovan and Puri 2004; Lambin et al. 2001). As tropical forests are destroyed or degraded, access to these products is lost, and livelihoods can suffer. Forest products are particularly crucial for the poorest of forest-dwelling peoples, as they buffer against economic shocks and perturbations. For example, when rural households lose crops to flooding or drought, they may turn to forest products as a means to offset their losses by hunting or foraging. Therefore, the loss of tropical forests not only threatens a generally vulnerable group of people, but exacts a particularly heavy toll among the poorest and most marginalized members among them.

## 1.5 Policy Options

For the reasons described above, there is strong interest in the international community in developing a comprehensive strategy to reduce deforestation and forest degradation in the tropics. These international initiatives exist in addition to national and sub-national efforts. In 2005, 80% of the world's forests were owned by governments, with most of the remaining forests privately owned. State-owned forests are managed in a variety of ways, however. For example, countries in the tropics together have 217.2 million hectares of protected forest area, or 19.6% of the global tropical forest (Scharlemann 2010). Protected areas, though, are hardly a panacea for conserving forests. Governments may designate protected areas in forests that under less deforestation and degradation pressure for economic reasons, however, studies have found that degradation persists even in these protected areas (Scharlemann et al. 2010; Duran-Medina et al. 2005; Ellis and Porter-Bolland 2008; Porter-Bolland and Ellis 2012).

Given that designating protected areas in state-owned forests has not succeeded universally, community-based forest management, wherein the people who live in, and have managed forests are given authority to manage forests locally, has presented itself as an alternative strategy. Community-based forest management (CBFM), and the local governance of natural resources (LGNR) more generally, has met with severely mixed results around the world (Mayers and Vermeulen 2002; Tokede et al. 2005; Ravikumar et al. 2012). The available evidence suggests that CBFM can be effective under certain circumstances, but much less effective otherwise.

Monetary incentives for conservation, including payments for environmental services (PES), are another important approach. The principle is simple – forest owners are compensated for maintaining standing forests, offsetting their opportunity costs. The approach has faced problems

including transaction costs associated with identifying forest owners in systems of complex (link to above), overlapping property rights and weak governance, costly monitoring, reporting and verification, leakage, and establishing additionality – that is, demonstrating that reductions in deforestation and forest degradation due to PES are greater than they would have been without PES.

The REDD+ initiative is currently the most advanced global effort to combat deforestation and forest degradation. The intuition behind REDD+ is that efforts to reduce tropical deforestation and forest degradation must be coordinated across countries to improve accounting and prevent leakage, the phenomenon wherein deforestation simply moves to an unmonitored location rather than being eliminated in response to a conservation policy. REDD+ does not prescribe a particular strategy for forest conservation, but rather aims to support multiple approaches including protected areas, sustainable community-based forest management, as well as PES.

This dissertation builds on a body of literature surrounding the factors that lead to particular forest governance outcomes, and develops through a systematic literature review (Chapter 2) several questions and hypotheses. The review suggests that inequality and heterogeneity of many types among forest users and within forest systems is a key driver of forest governance outcomes – but the mechanism by which, and indeed the direction in which, this effect operates is poorly understood. It also suggests that institutions, especially property rights, organizational structure, and rules-in-use both directly drive forest governance outcomes, and also mediate the effects of inequality and heterogeneity.

Understanding these dynamics is important because (1) the effective elaboration and deployment of forest conservation strategies is predicated upon a meaningful understanding of how coupled

natural-human forest systems work, and (2) the interplay between inequality and forest governance is itself interesting due to justice concerns. One of the principal criticisms of REDD+ and other tropical forest conservation policies is that already marginalized rural populations may be harmed while elites benefit from the incentives created by conservation.

## **1.6 Dissertation Methodology, Structure, and Findings**

The empirical analysis in this dissertation uses municipal data from Bolivia's lowland forests along with two community case studies to investigate these topics. I now describe the overall approach, the structure of the study, and the principal findings of each empirical chapter.

### **1.6.1 Why Bolivia?**

Bolivia is a sparsely populated country with substantial forest resources, high poverty, and varied forest governance regimes. Continuing decentralization and ongoing institutional reform have generated a rich and diverse landscape that is instructive with respect to the dynamics of forest governance in general. At the same time, findings from Bolivia cannot necessarily be generalized to other contexts. Thus, I pay particular attention to the historical context of Bolivia and especially to the communities that are used for the comparative case study sections.

### **1.6.2 Chapter 2: Systematic Review**

The systematic review of the literature attempts to synthesize findings on the factors that produce success in the local governance of natural resources in general, focusing largely on community-based forest management. An important issue that the field of scholarship faces is that there are myriad variables that affect forest governance outcomes, and different scholars have chosen to highlight different variables for their studies. Moreover, there are multiple outcomes of interest,



and not all studies attempt to study all relevant outcomes. In general, the three outcomes that are broadly studied – and ultimately the focus of the subsequent chapters – are (1) forest condition and natural resource (including forest) condition change, (2) livelihoods and total benefits derived from natural resource (including forest) exploitation, and (3) how equitably those benefits are distributed. The Institutional Analysis and Development (IAD) framework is introduced, and a theoretical framework linking inequality and heterogeneity, institutions, and outcomes – which are themselves suggested by the literature review – is presented.

### **1.6.3 Chapter 3: Inequality and Municipal Forestry Outcomes in Bolivia**

Using the collective action framework and a game theoretic analysis, hypotheses concerning the effects of economic and land-based inequality and forest governance outcomes are tested using municipal data from the Bolivian lowlands. These hypotheses involve land-inequality, measured by community land titling, and economic inequality, as drivers of three outcomes – forest condition change, forestry incomes, and changes in illegal logging.

I find that economic inequality and land inequality are variously associated with undesirable outcomes, all else equal. This is consistent with the general consensus of the literature, which is described in Chapter 2. This analysis also produces a novel finding, that land inequality and economic inequality seem to *moderate* each other's effect (that is, they interact in the OLS model) on forest condition change. Further questions that arise are (1) does this moderation necessarily occur? and (2) what is the mechanism of this moderation?

### **1.6.4 Chapter 4: Community Level Inequality, Local Networks, and Forest Governance**

To answer these questions, I take a closer and more qualitative look at two communities in the Bolivian lowlands, called TIM Ivirgarzama and Cururú. This comparative case study characterizes inequality in these communities, both of which have formal titles to their forest land. However, I find very different forest governance processes and outcomes in these two communities.

I first characterize economic inequality within these communities, and make the case that income and expenditures do not reveal a complete picture of important forms of inequality and heterogeneity. Instead, asset-based inequality is very important, especially in communities with weaker links to the cash economy, and sociocultural and ethnic heterogeneity can generate power imbalances through the creation and maintenance of local actor networks. I call the resultant phenomenon network-based inequality, wherein flows of rights and resources are determined by how different actors are connected, through kinship and other historical connections. Using data from these two communities, I argue that network-based inequality is a proximate driver of forest governance outcomes, and is itself shaped by other types of inequality and heterogeneity including economic, land-based, ethnic, and sociocultural heterogeneity.

### **1.6.5 Chapter 5: Institutional Design as a Driver and Mediator in Forest Systems**

While the previous chapter sheds light on the precise mechanisms through which inequality and heterogeneity drive forest governance outcomes, it also suggests two further questions: (1) why does network-based inequality form differently in different places, and (2) how may the adverse effects of network-based inequality be reduced?

This chapter begins where the previous chapter left off, continuing the comparative analysis of the two communities. Recent studies have suggested that institutional design is a key mediator of

inequality in forest coupled natural-human systems. Institutions are broadly defined as the formal and informal rules that constrain human behavior (North 1990). To study the relevant institutions, I draw from a large body of scholarship to focus on organizational structures, rules-in-use, and property rights. I find that Cururú is characterized by levels of poly-centric governance, wherein there are multiple loci from which rules are specified and enforced, and institutional redundancy, wherein multiple organizations perform the same functions and jointly hold power over key decision processes. From this analysis, I hypothesize that institutional redundancy and polycentric governance may *in general* promote effective *de facto* enforcement of *de jure* property rights, reducing the impact of network-based inequality and going some way towards explaining the moderation between economic and land-based inequality found in Chapter 2.

I return to the municipal data set to test these hypotheses, but find mixed results. While the presence of polycentric governance is associated with less forest degradation and high forest incomes, I do not find evidence that institutional redundancy and polycentric governance promote the *de facto* enforcement of *de jure* property rights. The chapter concludes with a discussion of these findings. In particular, I suggest that further study discriminate between community-level institutions and institutions that operate at higher levels. On the ground, it did indeed appear that Cururú's community-level institutions were most critical to its successes in CBFM, and there is also some evidence from the literature – particularly in Southern Mexico – that institutional redundancy at the community-level is a particularly strong promoter of effective and equitable forest management.

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## **Chapter 2 - Inequality, Heterogeneity, and Property Rights Institutions as Drivers of Outcomes in the Local Governance of Natural Resources: A Systematic Review**

To date, there have been severely mixed results in community forest management schemes with respect to multiple outcome variables (Mayers and Vermeulen 2002; Tokede et al. 2005; Ravikumar et al. 2012). The sustainability of forest resources themselves, the monetary benefits conferred to communities, and the distribution of these benefits within communities has been highly variable (Tokede et al. 2005; Yasmi et al. 2005; McCarthy 2001; Platteau 2004). The main purpose of this dissertation is to illuminate this puzzle, and contribute to a body of research that seeks to understand why these results are so mixed, and what really drives outcomes in the local governance of forest resources.

Given that roughly 15-16% of annual CO<sub>2</sub> emissions come from land use change, much of which is linked to tropical deforestation (Le Quéré et al. 2009), forest conservation schemes like the REDD+ program (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries and Enhancing Carbon Stocks) have been garnering increasing attention and urgency. The growing global interest in feasible avenues for climate change mitigation policy combined with the widely acknowledged importance of forests has placed community forest management and the local governance of natural resources (LGNR) at the center of important policy discussions. Large, and in some cases, growing, tracts of forested land are managed locally and by communities under a variety of informal and formal institutional regimes. As governments, NGOs, and the international community at large develop programs to assist these communities in the sustainable management of forest resources, a central question emerges: when is community forestry likely to succeed? More specifically, what are characteristics do successful institutions of local natural resource governance tend to have?

These questions emerge at the dynamic intersection of two bodies of literature: (1) the theoretical and empirical scholarship into the institutions of the LGNR social-ecological systems, and (2) the body of case studies and other empirical studies of community-based forest management. The first chapter of this dissertation is a systematic review of the most important literature from these areas, describing the main conclusions of the literature, the challenges that the field faces, and the specific questions that remain to be answered.

## **2.1 Local governance of natural resource social-ecological systems**

In the past two decades, a rapidly growing body of literature has coalesced around the study of local governance of natural resource (LGNR) social-ecological systems. This research has been motivated by the realization that existing economic theory was not effective at explaining observed outcomes in the governance of natural resources, particularly in systems characterized by resources that are highly subtractable (meaning that withdrawal by one user reduces possible withdrawal by others), but not easily excludable (meaning that it is difficult to control who can withdraw from the resource). These systems, or commons, have been the subject of many theoretical predictions. Hardin's 1968 essay *The Tragedy of the Commons* argued that rational actors in a commons without private property rights will always overexploit the resource beyond its socially optimal level, and will fail to achieve the level of collective action necessary to limit individual resource withdrawal to levels that will be in all actors' best interest. Hardin argued that there are two possible solutions to this dilemma: society can either clearly specify, allocate, and enforce private property rights that fully internalize the costs and benefits of each individual's use of the resource, or the state can strictly regulate individual resource utilization in a top-down fashion

In the following decades, Hardin's theory of the commons met with theoretical and empirical challenges. The central theoretical and intuitive challenge to Hardin's work is simply that most people have experienced instances of successful collective action in the governance of common pool resources, even if only on a small scale. Most people have shared resources with their families, friends, and communities with some success; were this not the case, individuals within family units would fail to ration even household food supplies successfully, all community members would litter in the streets without ever going through the trouble of disposing of waste appropriately, and the institution of the potluck dinner would be dead on arrival as no one would individually opt to contribute to them. Clearly, there are a variety of conditions and institutions – formal and informal rules that constrain human behavior (North 1990) - that prevent these outcomes at a variety of scales. These concerns have motivated a large number of empirical studies that provided further problems for Hardin's theory of the commons. Elinor Ostrom's *Governing the Commons* and a large body of subsequent literature has focused broadly on the conditions that facilitate sustainable management of the commons without strict privatization or absolute central planning. The empirical literature suggests that communities can, but do not always, manage their natural resources sustainably and equitably.

In spite of more than 20 years of research aimed at characterizing these complex coupled natural-human systems with respect to how biophysical, socioeconomic, demographic, cultural, and institutional factors jointly drive outcomes, a comprehensive theory of the commons remains elusive. Part of the problem is in the sheer variety and complexity of these systems, and their resultant recalcitrance to truly comprehensive and uniform study methodologies. A meta-analysis of the commons literature by Arun Agrawal (2001) identified at least 35 factors that scholars had determined to be drivers of the quality of outcomes in LGNR. Moreover, "outcomes" are

themselves not one-dimensional. Outcomes of interest in social-ecological systems can involve institutional durability (e.g., Falk et al. 2011, Sarker and Itoh 2001, Bardhan and Dayton-Johnson 2002), livelihoods, resource sustainability, and equity (Agrawal and Benson 2011). Agrawal and Benson, in a meta-analysis of relevant literature to date, found that only 11 of 152 studies they reviewed assessed all three outcome dimensions that they identified (resource sustainability, livelihoods, and equity); comparatively few assessed more than one type of outcome at all. In spite of this apparent disjointedness of the literature, initiatives like International Forestry Resources and Institutions (IFRI) have made important steps to collect data on forest social-ecological systems using a uniform framework across the world. Still, the large body of scholarship that has used IFRI data does not - nor should it necessarily - reflect a consensus with respect to empirical strategies, or what variables are most important for analysis. There are, therefore, two important questions that stand out in the context of this literature: (1) of the many factors that have been linked to multiple outcomes in LGNR, which seem to be the most important? (2) how can the lessons from the literature be effectively translated into actionable policy design principles? and (3) what research methodologies have had the most success in producing robust and actionable information? The first goal of this systematic literature review is to answer these questions.

One particularly important instance of LGNR is community-based forest management (CBFM). It has been explicitly studied in the past few decades, and interest in the field has increasingly joined with global forest conservation scholarship driven largely by concerns over anthropogenic climate change. Community-based forest management is a particular instance of LGNR, with some key characteristics that make it socially important and intellectually challenging to study in its own right. Tropical forest resources are stationary, slow to regenerate, provide a large suite of

important environmental services, and may require significant human and physical capital to exploit. In addition, tropical forests are often central to the livelihoods of local populations, who are usually very poor and vulnerable to economic and climatic shocks. These conditions of tropical forest systems set them apart from other natural resource systems.

While some sophisticated meta-analyses (e.g., Agrawal 2001; Agrawal and Benson 2011; Berkes 2007; Menzies 2004) have addressed the LGNR in general, and in some cases forests in particular (e.g., Menzies 2004; Richards 2002; Richards 2009; Singh 2008), the very extensive literature has not been reviewed systematically in the context of its importance for conservation and natural resource management policy. The second aim of this systematic review is to bring the rich, largely case-driven literature on community-based forest management into the broader discussion of how LGNR can inform and augment effective conservation policy. The questions that this component of the analysis addresses are: (1) what factors condition the success of LGNR? and (2) what implications does the literature present for policy making and further research? Because the literature on community-based forest management is largely a subset of the literature on the LGNR, these specific CBFM questions will be assessed concurrently with the other research questions.

## **2.2 Systematic Review Methodology**

To begin, two simple and broad search terms were used in Google Scholar and the ISI Web of Knowledge to amass a large number of articles with possible relevance to these two literatures: “local governance of natural resources”(LGNR) and “community based forest management” (CBFM) were entered as database search terms to find the top articles on the subject. In addition



to simply taking the top articles, multiple relevant articles were downloaded from special issues of journals pertinent to the subject.

Often times, Google scholar is biased towards older publications with more citations. To mitigate this effect, a time-specified search was run to ensure a suitable proportion of studies from 2010 and later. These initial procedures yielded 832 results, which was subsequently pared down to the most relevant titles, or 200 articles. By reading the abstracts of these papers, 100 papers were selected for this review according to the following review criteria. Guidelines for this procedure conformed to the recommendations of the Centre for Evidence-based Conservation.<sup>6</sup> Studies were excluded unless they met two criteria:

- (1) An explicit focus on LGNR or community-based forest management
- (2) An emphasis on developing countries and tropical forests, although studies of developed countries with an orientation towards comparison with developing world institutions were included (e.g. Sarker and Itoh 2001)

Then, preference was given to studies that (1) included some analysis of institutions, construed broadly, and (2) were cited by others. The selection of relevant studies was conducted according to the

### **2.3 Drivers of multiple outcomes in local governance of natural resources**

Arun Agrawal's 2001 review paper on the reports, the literature on the local governance of natural resource presents a very large number of factors – approximately 35 depending on how

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<sup>6</sup> Guidelines available at <http://www.environmentalevidence.org/documents/guidelines.pdf>

they are grouped, in the author's estimation - that drive outcomes in natural resource social-ecological systems. He argued that this abundance of important factors causes individual studies, particularly case studies, to suffer from omitted variable bias. Because individual authors must select and emphasize only small subsets of these factors for any particular study, the external validity of most of the literature in the field has been relatively low. Mahanty et al. (2006) criticized the poor understanding of the dynamics of community-based forest management (CBFM), arguing that there are too many unsubstantiated assumptions that guide its implementation. They argued, based on evidence from Nepal, Laos, India, and Thailand, (1) that CBFM projects are too myopically focused on timber resources to comprehensively address the requirements of impoverished people, (2) that decentralizing the governance of natural resources to the local level does not at all guarantee an equitable distribution of benefits from natural resources among local people, and (3) that emphasizing low-quality and degraded forests is a misguided strategy for the sustainability of resource systems and livelihood enrichment. These striking findings, which to some extent challenge the core justifications of CBFM, are variously supported and contradicted by other scholars. The literature, by and large, has not produced a consensus about what assumptions ought to guide local natural resource management, nor which factors are the most important determinants of outcomes in these systems.

In addition to problems that arise from the number of key variables that characterize the dynamics of natural resource management in social-ecological systems, there are also multiple outcomes that are of interest. Agrawal and Benson (2011) conducted a meta-analysis of 152 papers that studied the LGNR. They identified three key outcome dimensions of interest – livelihoods, equity, and resource sustainability. Of the 152 studies that they reviewed, only 11 (7.3%) addressed all three. Moreover, in this meta-analysis, 40 causal variables grouped into five

over-arching categories were defined. Chhatre and Agrawal (2009) used IFRI data from 10 countries to assess the degree to which livelihood and resource sustainability outcomes are positively or inversely correlated. They found that there is no significant unidirectional relationship between the two outcomes. In other words, depending on other factors, there may be trade-offs or synergies between multiple outcomes. The implication is that the rich literature on the LGNR – while extensive and also intensive in many respects – lacks a consensus about what the important inputs and outputs of local resource governance are, and how these inputs and outputs ultimately shape different outcomes.

This section builds on previous reviews of the literature to characterize the most commonly cited factors that drive outcomes in social-ecological systems. The methodology employed below goes beyond simply counting the number of times that factors are emphasized by the literature selected for this systematic review; it also assesses the overall quantitative importance of factors (to the extent that these have been assessed by the literature), and qualitatively explores the type of importance they hold. Table 1 (below) summarizes these findings). Before presenting the findings from the literature that pertain to the specific research questions of this dissertation, a brief introduction to the study and analysis of institutions is provided.

## **2.4 Institutions and outcomes in social-ecological systems**

Institutions are central to this study. Defined as the formal and informal rules that constrain human behavior (North 1990), institutions can take on a variety of forms to constrain and enable behaviors in a large variety of ways. How do institutions – such as property rights, decision-making processes, and sociocultural norms – interact with non-institutional characteristics of social-ecological systems to produce outcomes? This is a very broad question that has been

assessed by scholars from a variety of fields including economics, sociology, political science, and environmental studies. Alston et al. (1996) make the case that institutions are the critical mediators of important inputs into human systems. Leach et al. (1999) posit that environmental goods and services are distributed among individuals and groups by institutions. They start with Amartya Sen's environmental entitlements model, which suggests that individuals have certain endowments (physical property that is conferred to them by some *a priori* arrangement, or their own labor resources) which can be converted into entitlements such as cash income, social capital, or other useful resources. They posit that Sen's model is incomplete, because it underemphasizes institutions. These institutions, which operate at all scales, mediate the conversion of environmental goods and services into endowments and entitlements. (Figure 2.1).

**Figure 2.1 The Environmental Entitlements Framework**

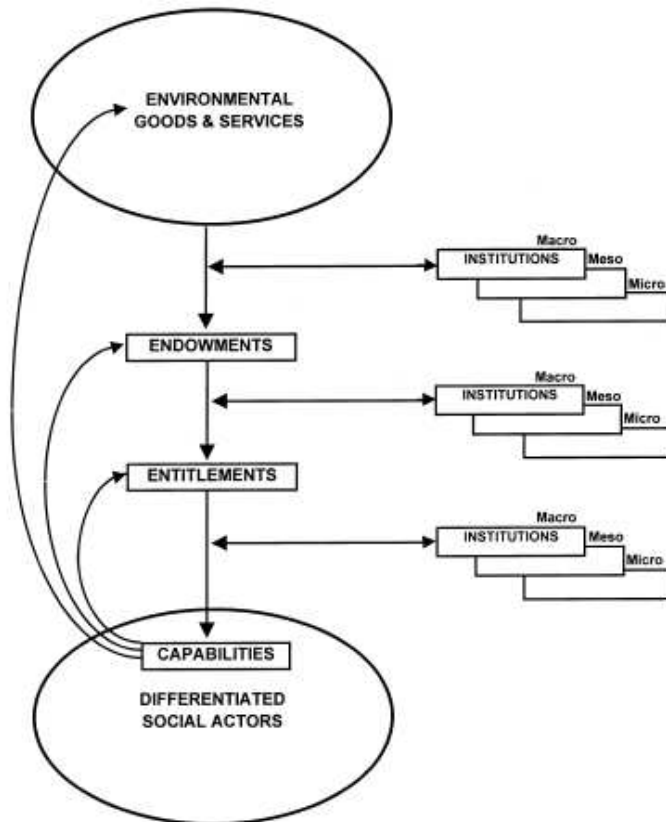


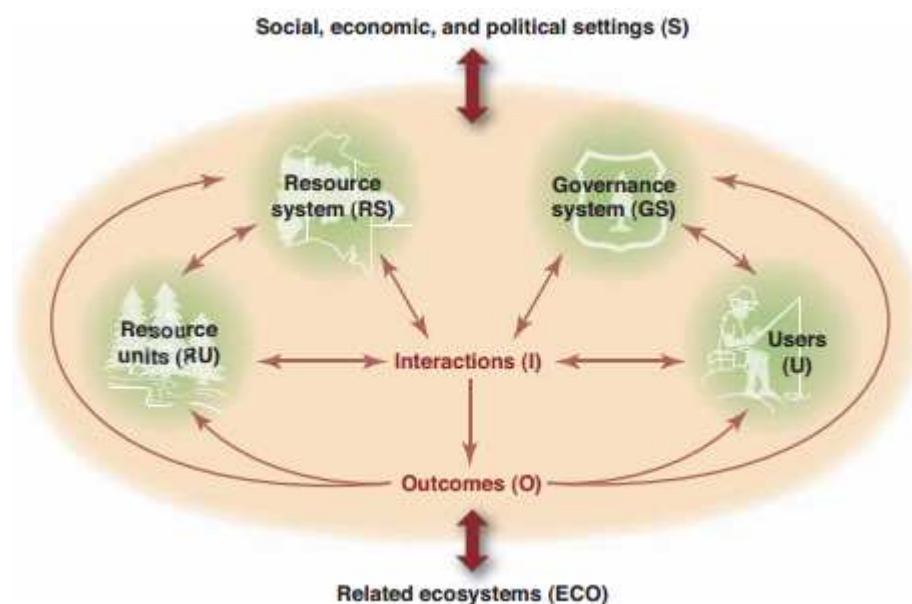
Figure 1. *Environment entitlements framework.*

Source: Leach et al. (1999).

Alston et al. (1996) argue that institutions, like property rights, effectively add value to natural resources. Institutions, in the Leach et al. framework, play a key role in transforming environmental goods and services from endowments into entitlements and ultimately capabilities. Elinor Ostrom's work has been instrumental in delineating the different systems that interact to produce outcomes in social-ecological systems. Figure 2.2 shows the key sub-systems that interact within the broader systems. Ostrom argues that identifying the components of social-ecological systems that are common and important will allow findings from research in the field to accumulate more effectively and uniformly. Thus, she identifies several domains of variables: social, economic, and political settings (S); resource systems (RS); resource units

(RU); governance systems (GS); users (U); and related ecosystems (RO). These sub-systems interact, according to Ostrom's framework, to produce outcomes.

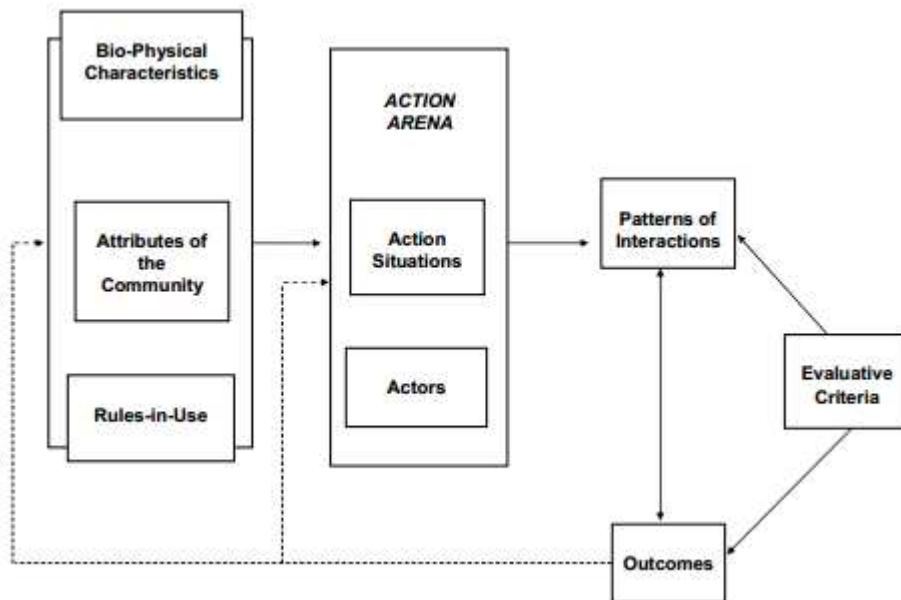
**Figure 2.2 Key Subsystems of Social-Ecological Systems**



The space in which these subsystems interact can be thought of as the “action arena” (see Figure 2.3 below). The action arena is the interface at which institutions, biophysical characteristics of a resource system, and community attributes create action situations wherein actors make decisions that produce outcomes. The particular dynamics of the action arena remain an important area for study, and some of the important institutional determinants of the characteristics of the action arena are the focus of this study (heterogeneity, inequality, and property rights). The IAD framework is a useful schematic for understanding how different elements of social-ecological systems – including heterogeneity, inequality, and institutional design, which this dissertation focuses on – fit together. Given this dissertation’s focus on specific elements of the IAD framework, it is used as a conceptual tool here rather than analytic one.

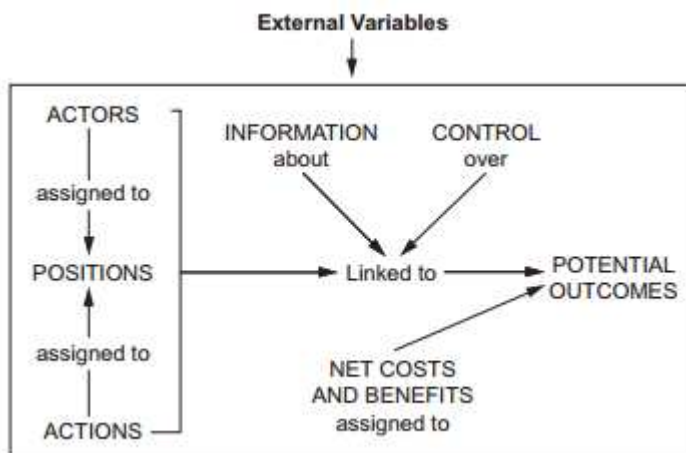
Though it's clear that rules-in-use and institutions are critical components of social-ecological systems, it is less clear how these institutions are formed in the first place; and also how they evolve. Klooster (2000), through a study in Mexico, examine the factors that lead communities to invest or not invest in better institutional arrangements. Their theoretical framework, a variant of institutional choice theory, treats institutions as assets that require investment. As in other systems, there are sub-optimal stable equilibria wherein investing in better institutions would yield a Pareto improvement, but nevertheless investment doesn't occur. For example, Klooster found that some Mexican communities were able to set up multiple community-based forest councils (one elected and one appointed, for example) that were able to check each other and generate more democratic forest management. NGOs were instrumental, he found, in facilitating such investment. In other cases, such collective action to invest institutions fails.

**Figure 2.3 The Institutional Analysis and Development (IAD) Framework**



While the overall IAD framework has been favored by many scholars, the particulars of its application vary considerably, and researchers are left to consider – often *a priori* to specific empirical and theoretical inquiry – important questions. For example, what rules-in-use are likely to be important in their system of interest? What attributes of the community should be studied? Who are the relevant actors and what are the action-situations that are likely linked to outcomes of interest? What *are* these outcomes of interest anyway? The IAD framework offers a useful way to consider the interplay between many factors in social-ecological systems. The action arena in the diagram above is a particular interesting area that has seen recent theoretical development. Figure 2.4 provides a closer look at the action arena and the elements within it. Actors and actions are assigned to positions in this schematic. These actors then take actions through their position, subject to information and rule-based constraints, leading to a host of potential outcomes with various costs and benefits.

**Figure 2.4 The Institutional Action Arena**



There is no one well-established way to think about these questions. As noted by Agrawal (2001) researchers have come up with many different answers to these questions. By breaking down relevant literature into its component parts, a variety of institutional and non-institutional drivers



of outcomes in the LGNR have emerged. These categories were not selected in advance, but were generated based on a review of (1) what topics were common in the literature, and (2) how these topics fit with the categories delineated in the frameworks described above. Table 2.1 (below) shows the relative frequencies of these classes of factors being emphasized in the literature. Table 2.1 defines each of these factors, and how they were applied to the studies included in this systematic review.

**Table 2.1 Descriptions of the classes of drivers studied in this review**

<b>Class of driver</b>	<b>Description</b>
Heterogeneity	The heterogeneity category was interpreted broadly. Studies that found class, caste, race, socioeconomic, geographic, religious, gendered, power-based, or other heterogeneities to be important drivers of outcomes in the local governance of resources were counted. For further information on heterogeneity, see Agrawal (2001), Poteete and Ostrom (2004), Varughese and Ostrom (2001), Andersson and Agrawal (2011)
Access and Withdrawal Rights	Studies were listed as finding access and withdrawal rights if they cited clearly defined boundaries for natural resources use, resource excludability, or rules about who can use what when were included in this category. See Schlager and Ostrom (1992), Adhikari et al. (2004)
Management Rights	Management rights are a very diffuse type of property right. Thus, studies that found that any of (1) who makes management decisions, (2) what management decisions are made (which can overlap with rules in use, described below), or (3) how management decisions were important in determining local resource governance outcomes were counted in this category. See Schlager and Ostrom (1992), Springate-Baginsky et al. (2003).

Monitoring, reporting and/or verification	Studies that found that it was important (1) whether there was monitoring of resources and behaviors, (2) who monitored, (3) how monitoring was done, or (3) how costly monitoring was were included in this category. See Topp-Jorgensen et al. (2005), Duthy and Bolo-Duthy (2005), Hauzer et al. (2012)
NGOs	The role of NGOs in mediating other processes and shaping institutional outcomes has been a common subject of study. Those studies that found NGOs to have an important effect were included in this category. See Engel and Palmer (2006), Andersson (2004).
Biophysical	Studies that found that biophysical characteristics of the natural resource system played an important role in driving outcomes were included in this category. This included the condition of the resource (which was often discussed in conjunction with the value of the resource - see market characteristics below), the mobility of the resource, or the type of resource. See Phelps et al. (2010), Ostrom (2009).
Market characteristics	Market characteristics are another broad category. Most commonly, proximity to markets was discussed. The prices of resource units or costs of production, along with dependence on natural resources (because this affects the opportunity costs of alternative uses of natural resources) were included in this category. Studies that found these to be important were included in this category. See Phelps et al. (2010), Ostrom (2009), Ellis et al. (2008)
Demographics	Demographic characteristics included group size, group structure, and migratory patterns. See Robinson and Berkes (2011), Poteete and Ostrom (2004).
Forest binary	This binary simply reflects whether or not the study focused exclusively on forests, or included other resources as well.

Rules in use	Rules-in-use are the types of constraints on individuals behaviors surrounding resource use, management decision making, or interactions with other groups of actors. See Ostrom (2009), Agrawal (2001).
Social capital	Social capital can refer to the frequency and nature of interactions within and between local groups of actors, and the amount of mutual trust in these groups. Studies that found these to be important drivers of outcomes in the LGNR were included here. See Klooster and Masera (2000), Bowles and Gintis (2000), Van Laerhoven (2011).
Community values	Community values include the sociocultural preferences and more intrinsic values of communities with respect to conservation, natural resource use, and other factors. Studies that found these to be important were counted in this category. See Li (2002), Ostrom (2000).

These characteristics of systems which emerge from the literature are described below. Not all characteristics are mentioned and studied equally. The frequency with which the different characteristics are studied ranges from 0.075 (for NGOs) to 0.7375 (for management rights).

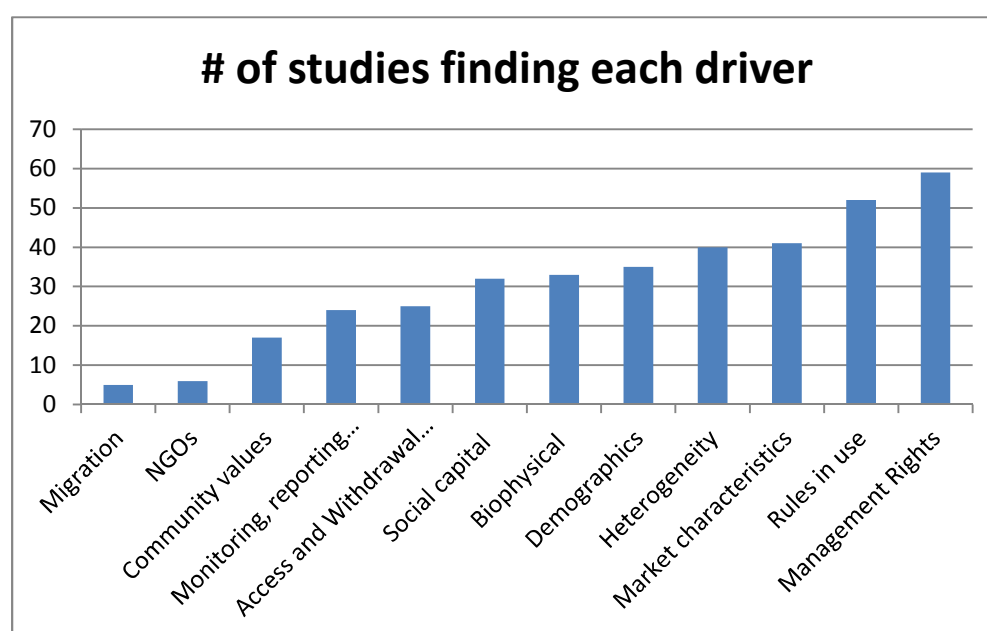
**Table 2.2 Descriptive statistics from systematic review**

Driver of LGNR outcome	Obs	Frequency	Driver		
Heterogeneity	80	0.5	Biophysical	80	0.4125
Access and Withdrawal Rights	80	0.3125	Market characteristics	80	0.5125
Management Rights	80	0.7375	Demographics	80	0.4375
Monitoring, reporting and/or verification	80	0.3	Forest binary	80	0.7

Migration	80	0.0625	Rules in use	80	0.65
NGOs	80	0.075	Social capital	80	0.4
Community values	80	0.2125			

Figure 2.5 shows the distribution of these characteristics' mentions graphically, by number of mentions.

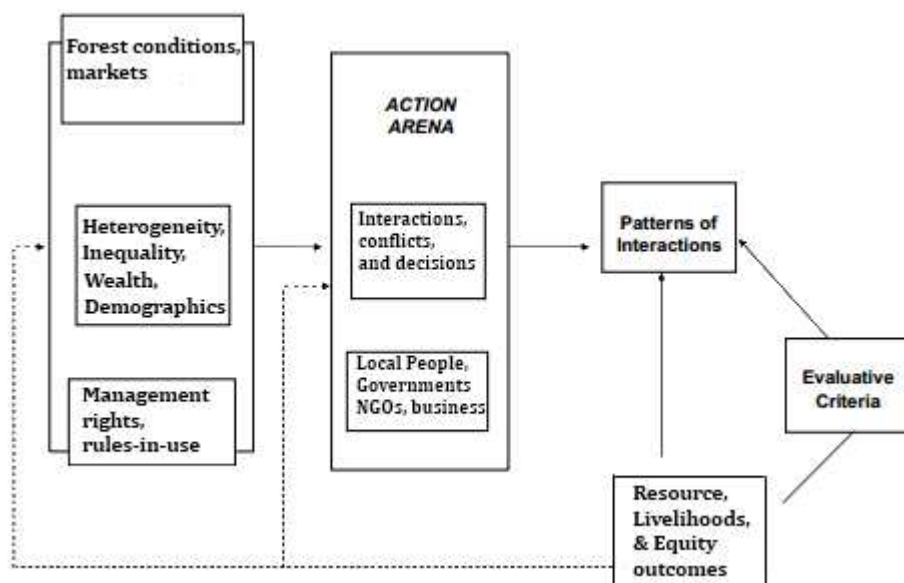
**Figure 2.5 Drivers of Forest Governance in the Literature**



Note that these classes of drivers do not always fit neatly into the frameworks shown in the figures above. This is because each class of drivers can be further decomposed into a variety of different variables, each of which have been measured differently by different scholars. For example, management rights may be measured very differently by different scholars; and be categorized variously as community attribute, rules in use, or even patterns of interaction. Nevertheless, it is useful to look at how often different types of variables were found to be important in the literature. Figure 2.5 (above) shows how often different classes of these drivers

came up in the literature visually. Management rights and rules-in-use were the most commonly occurring institutional factors. Heterogeneity was also a common institutional factor. Other institutional factors like social capital, access and withdrawal rights, community values, and the role of NGOs were less important (but still occurred in the literature). Of the non-institutional factors, market, demographic, and biophysical characteristics were all commonly cited. The role of rules-in-use and management rights can, to some extent be grouped. Although they are legitimately different concepts that do not always occur together in the studies reviewed in this systematic review (Pearson  $r = .217$ ;  $p = .0527$ ), they both comprise broad sets of institutional considerations. Heterogeneity is another important institutional consideration, and it is a key focus of this review and dissertation because it is particularly contested and poorly understood. Other factors, however, cannot be excluded from any analysis of local governance of resources in general or community-based forest management in particular. Indeed, as many of these factors should be included in a good analysis as possible so long as model over-specification doesn't become prohibitive for meaningful analysis. The next two sections explore what the literature says in particular about heterogeneity and property rights (including management rights), what conclusions are largely shared by scholars, and what questions remain to be investigated. The linkages between these areas can be seen through the IAD framework (Figure 2.6). The IAD framework shows how some of the concepts discussed above are connected. Heterogeneity, for example, is a key attribute of the community. Market conditions and biophysical forest variables are also key characteristics that influence the action arena of the social-ecological system. Within the action arena itself, rules-in-use and the distribution of management authority can be considered; these are the factors that link different positions with different actors, and delimit the types of actions that can be taken by actors.

**Figure 2.6 – IAD Framework in Application**



This framework shows the relationship between the broad suite of relevant external conditions, the action arena in which decisions are made, and the types of outcomes that are generated. Heterogeneity and inequality are one type of institutional starting condition, and the allocation of property rights (including management rights and the distribution of decision-making authority) constitute another set of important institutional parameters. The next two sections explore the literature on these topics, and a framework showing *how* each drives outcomes is ultimately presented. A key implication of the above schematic is that inequality and heterogeneity *interact* with forest market conditions, management rights, and rules-in-use. This framework is useful to conceptualize the connections between the themes that are explored through the empirical analyses, but is not applied as a rigorous analytical framework itself. Rather, the relationships between inequality and heterogeneity, institutions, and forest governance outcomes are assessed through a variety of empirical strategies. The IAD is nevertheless useful as a conceptual tool.

## 2.5 Inequality and heterogeneity

Throughout the literature, one recurring focus of study is the influence of heterogeneity, which can be defined in a variety of ways, as a driver of outcomes in the local governance of natural resources. A central focus of this section of the literature is on ascertaining the influence of inequality and heterogeneity on other outcomes in social-ecological systems, and also to assess the factors that affect inequality itself. Adhikari (2005) found that community based natural forest management exacerbated inequalities in Nepali communities, with pre-existing levels of socioeconomic heterogeneity. However, Varughese and Ostrom (2001) find through a comparative case study also in Nepal that heterogeneity communities can be overcome to achieve successful collective action with effective institutions. Some of the communities they studied in Nepal introduced multiple roles in forest governance with distinct rights and obligations, in order to actually incorporate the multiple dimensions of heterogeneity in the community into the management plan. Adhikari and Lovett (2006) found that in general, heterogeneity of caste and land access was associated with poorer collective action outcomes. On the other hand, their sample of seven Nepali Forest User Groups showed only a weak effect of heterogeneity, and the authors were not able to extricate the impact of heterogeneity from the impact of institutions.

Meshack et al. (2006) collected data from households in Tanzanian CBFM systems to assess household transaction cost burdens against household poverty. They found that poorer households, as a share of their incomes, paid a greater share of transaction costs associated with CBFM, such as monitoring and verification. In spite of this relatively greater investment, wealthier households tended to benefit more from CBFM. Bardhan and Dayton-Johnson (2002) conducted a meta-analysis of scholarship on these issues from Nepal, Mexico, and India. Based

on their findings, they posit non-linear U-shaped relationship between heterogeneity (a concept for which they construct a detailed typology) and governance outcomes. More recently, Uberhuaga et al. (2011) assessed heterogeneity, including social and economic varieties, as likely drivers of natural resource management outcomes. They studied communities in Bolivia, and focused on livelihoods as the outcome of interest. In these cases, they found that heterogeneity – particularly wealth inequality – makes successful collective action very difficult as local elites use their social and physical capital to capture benefits by forming unilateral contracts with private firms to harvest and sell timber. Other scholars have analyzed primary data and conducted meta-analyses to confirm that the effect of heterogeneity is indeed potentially ambiguous and strongly mediated by local institutions (Poteete and Ostrom 2004; Andersson and Agrawal 2011). Thus, study results that posit a fairly strong negative association between heterogeneity and outcomes in the local governance of natural resources (e.g., Uberhuaga et al. 2011; Adhikari et al. 2011) are not necessarily at odds with the conclusions of Varughese and Ostrom. A more accurate interpretation of such failures of collective action in the face of heterogeneity is that these communities did not, in general, have institutions that were capable of facilitating successful collective action in common pool resource management under conditions of heterogeneity.

While these studies have shown that institutions are important in mediating the effects of the various flavors of inequality on natural resource governance outcomes, it can be problematic to focus exclusively on institutions. Agrawal (2001) argued that while recent scholarship's focus on institutions has been theoretically justified, having such a focus in excess runs the risk of ignoring other important economic, environmental, and other factors that are essentially exogenous. Agrawal and Yadama (1999) had previously found this to be the case through a



quantitative case study in Northern India. They found strong empirical support for their theoretical model, which posited that market and population pressures (population pressures were measured as population per resource unit, distance to paved roads, and forest user group size; market pressures were measured as number of tree species present and the average age of the stand) directly affected forest condition and also had indirect effects mediated by institutions. The institutional conditions that they measured were frequency of meetings in communities, the frequency of elections, and the frequency of hiring new guards to monitor the forest condition. Cinner et al. (2011) conducted a four-country quantitative comparative case study on fisheries management. They found that co-management (i.e., collaborative governance between governments and communities) is generally successful at conserving resources. However, specific outcomes were mixed with respect to both livelihood and resource sustainability, and elite capture of benefits was recurrent across contexts. Their results also suggested that resource exploitation is predominantly influenced by market access and users' dependence on the resource (so-called "exit options"). Institutional characteristics were important drivers of livelihood outcomes, but were strikingly insignificant with respect to resource system conservation. Baland and Platteau (1999) also found non-institutional drivers of outcomes through a modeling exercise. They modeled the behaviors of fishermen in a fishery with varying degrees of inequality, and the benefits that the fishermen accrue in different scenarios. Their striking finding was that, depending on available technologies – but without explicitly considering institutions – very high inequality can yield a Pareto (or, if preferred, Rawlsian) optimum with all actors unambiguously better off. These effects are termed "Olson effects" by Bardhan and Dayton-Johnson (2002) following the theoretical predictions of Mancur Olson (1965). Olson's theory suggests that in governance systems with high inequality, some actors stand to benefit more from

investment in a common pool resource. Thus, with high inequality, actors with large capital stocks and high stakes in the common pool resource will be willing to invest heavily in the resource even though other users will free-ride. Olson's own words provide the best explanation of his theory:

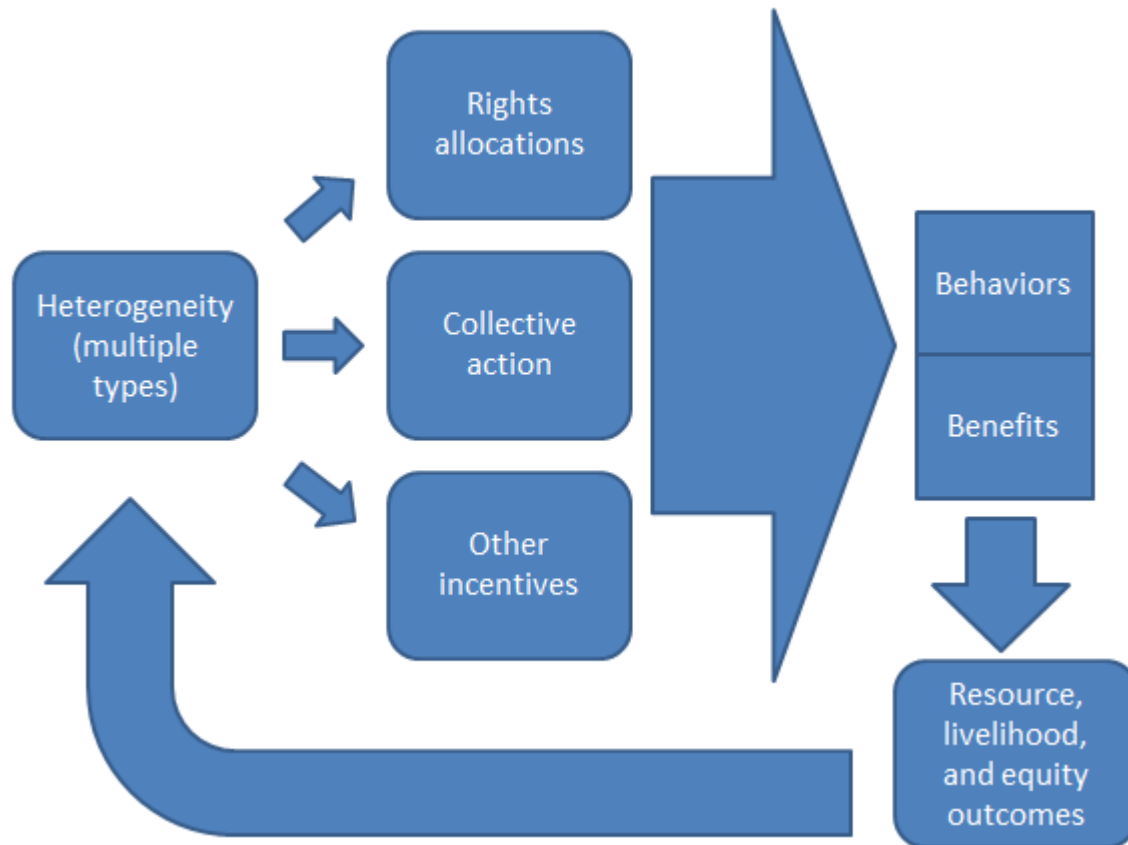
In smaller groups marked by considerable degrees of inequality – that is, in groups of members of unequal "size" or extent of interest in the collective good – there is the greatest likelihood that a collective good will be provided; for the greater the interest in the collective good of any single member, the greater the likelihood that that member will get such a significant proportion of the total benefit from the collective good that he will gain from seeing that the good is provided, even if he has to pay all of the cost himself.

Perez-Cirera and Lovett (2006) studied the influence of heterogeneity in 38 Mexican *ejidos*, with multiple measures of heterogeneity. They found that in general, some types of heterogeneity and inequality are associated with increases in illegal logging, but others can actually cause elites to invest in activities that benefit non-elites – arguably, an “Olson effect.” The result is inequality that can to some degree self-perpetuate, but can also increase overall livelihoods. McDermott and Schreckneberg (2009) conducted a multi-country comparative case study, and found that while elite capture is common across contexts, local governance of resources can still provide benefits to the community as a whole. Thus, even if poor households do not enjoy a fair share of the direct benefits from natural resource management, they still may benefit as the community becomes wealthier in general. Other empirical studies, such as those described above, raise doubts as to how often Olson's theoretical predictions manifest themselves on the ground.

Overall, a dynamic and interactive picture emerges in which heterogeneity changes rules and institutions, and produces, precludes, or otherwise influences collective action. The conditions under which different types of heterogeneity produce more or less collective action – and

ultimately better or worse outcomes of LGNR – remains contested. Figure 2.7 presents a schematic of how heterogeneity plays an important role in social ecological systems.

**Figure 2.7 Heterogeneity as a driver of outcomes in LGNR**



Apart from these studies, there are relatively few studies that explicitly examine the heterogeneity and inequality as drivers of outcomes of local resource governance (exceptions include Gautum (2002); Gibson (2001); and Gibson and Becker (2002)). The mechanisms through which heterogeneity interacts with governance processes in social-ecological systems remains poorly understood. Moreover, while there is a consensus among scholars that institutional arrangements mediate the effects of heterogeneity, robust descriptions of what these









institutions might look like are strikingly sparse. Three specific questions therefore emerge. They are, (1) through what mechanisms do various types of heterogeneity influence the local governance of natural resources? (2) what are the specific institutional arrangements that can successfully mediate the negative impacts of heterogeneity? and (3) how are these institutions produced and sustained? There are several answers that the studies discussed above suggest to these questions, but there is no consensus. Continuing to rigorously investigate these questions with an explicit orientation towards delineating between generalizable and non-generalizable conclusions represents an important and useful path for further study.

## **2.6 Property rights**

Property rights are another important theme in the scholarship of local natural resource governance. Property rights play a key role in social-ecological systems, as the central institution that determines who is permitted to do what, and when and where they're permitted to do so. Scholars of the commons have often recognized the critical importance of property rights. In general, scholarship related to the influence of property rights on the local governance of resources has – in spite of variation in the typologies of property rights that have been applied – converged around at one simple consensus: clear and secure property rights tend are good, *ceteris parabis* (Pagdee et al. (2006) conducted a meta-analysis that clarifies this point).

There have been many efforts to create typologies of and characterize property rights. Schlager and Ostrom (2002), for example, described a hierarchy of classes of property rights holders (Table 2.3).

**Table 2.3 Bundles of rights associated with rights-holder types**

	Owner	Proprietor	Claimant	Authorized User
Access and Withdrawal				
Management				
Exclusion				
Alienation (Transfer)				

Source: Schlager and Ostrom (1992)

In this hierarchy, there are four ‘sticks’ in the bundle of rights. In ascending order, they are (1) access and withdrawal, (2) management, (3) exclusion, and (4) alienation. Having hierarchically higher rights implies having all subsidiary rights; it is, for example, impossible to have exclusion rights without having management, access, and withdrawal rights. An actor with all of these rights is considered an ‘owner.’ This typology has been employed by scholars in a variety of

contexts. Menzies (2004) argued that communities require secure management rights in order to manage common pool resources sustainably and beneficially, but this is often not the case in many countries. Schafer and Bell (2010) found that in Mozambique, there were *de jure* efforts to devolve rights to communities, but *de facto* maintenance of management, and even basic access and withdrawal rights by the state. Alston et al. (2009) describe two key processes associated with property rights of all types: specification and enforcement. They find that as property rights are specified in open access or frontier regions, conflict can emerge as they are enforced depending on how much collective action exists beforehand. The implication is that the different rights identified by Ostrom et al. can be *de facto* or *de jure*, and can be specified and enforced through a variety of mechanisms, which will have different consequences for the resource system. This framework is an excellent starting point for this investigation, but still requires higher resolution in certain categories. Further characterization of, for example, management and withdrawal rights that exist in practice will allow policy makers to develop strategies to engage with these specific roles that people have. Often times, there are distinctions between *de facto* and *de jure* property rights that are only apparent at these more highly resolved scales. For example, in a community-governed forest, all adult community members may officially and legally hold the same “management rights:” they are all required to attend community assemblies every month, where community members can propose and vote on important decisions. In practice, however, there may be subtle, socioculturally specific impediments to the participation of some individuals compared to others. *De facto* management rights may not be uniform among local people that are involved in natural resource governance. In other words, some individuals may have more power than others for reasons that are not obvious or easily measured.

Whereas Schlager and Ostrom's typology of property rights reflects some of the types of rights that individuals may hold, others have emphasized the importance of who holds rights at all. Wang and van Kooten (2001) offer a typology of different types of resource systems, each characterized by different dominant players. In this typology, private property is characterized by well-defined and complete property rights. The term "complete" can be understood in the sense of being a full "owner" in Schlager and Ostrom's typology. State ownership is characterized by often poorly defined rights for users and non-state actors, with some degree of collective decision making through the apparatus of the state. The nature of the state – the degree to which it is democratic, for example – will influence what state ownership looks like in practice. Common property is characterized by some restrictions, but ultimately shared ownership-rights for community members (although the definition of "community" is often contested in the literature, e.g., Li 2002) that approach private property in some respects. Finally, open access systems are characterized by no exclusion and uncontrolled access to resources. Given that so many tropical forests are owned by the state, with certain other rights allocated to individuals and communities, it is important to bring these typologies together in a useful way. In spite of these useful typologies, there has not been any recent synthesis in the characterization of property rights – especially one that is explicitly designed to be applied by policy makers and conservation-oriented organizations to better understand likely outcomes of various policy alternatives.

#### **Table 2.4 Property rights typology by owner type**

	<b>Property rights degree of definition</b>	<b>Exclusive characteristics</b>
<b>Private property</b>	Well defined, complete property rights.	Exclusive rights assigned to individuals.
<b>State ownership</b>	Less defined for individual use, usufruct rights generally given in form of leases, tenures or permits.	Rights held collectively with control exercised by authority or designated agency.
<b>Common property</b>	Restricted or stinted users, multiple quota rights or other reserves for special users.	Exclusive rights assigned to all members of a community; approaching private property.
<b>Open access</b>	Unlimited users and uncontrolled access.	Exclusive rights unassigned.

Adapted from Wang and Van Kooten (2001)

Both of these typologies are referred to – explicitly and otherwise – by scholars. Chhatre and Agrawal (2009) found, using IFRI data, that government-owned forests are more likely to be characterized as unsustainable commons (i.e., to have below average livelihood and carbon storage). Merry et al. (2006) found that frontier communities in Brazil were more likely to participate actively in the local governance of resources if they not only had legal titles, but also had joint management partnerships arranged with private firms. Schreckenberg and Luttrell (2009) found that in Tanzanian CBFM systems, the central government had at times imposed sweeping bans on resource withdrawal. This compromised the sustainability of local resource governance systems until the ban was lifted. This finding, that tenure security drives the behavior of rights holders – has been corroborated by other scholars. Agrawal and Chhatre (2008) found that, in sites around the world, poor enforcement of property rights in forest systems tends to produce illegal logging. Kusters et al. (2007) found that, in Indonesia, local peoples’ perception of their tenure security was positively associated with ecologically sustainable behaviors. The implication is that scholars need to consider *who* holds *what* rights, and in *what sense* (i.e., *de*



*facto* or *de jure*). It is important to recognize that inequality is also embedded within property rights institutions. Some actors are endowed with more extensive, more well specified, and more rigorously enforced property rights than others.

An additional dimension of property rights that bears mentioning is time. The temporal dimension of property rights, which bears particular importance for so-called property rights “security,” has been found to have critical effects on the local governance of resources by way of the behaviors of property rights holders. Iskandar et al. (2006) compared the two dominant types of forestry concessions in Indonesia. The first of these, which are known as IPPK concessions, were short-term arrangements that are generally held by communities. The second – HPH concessions – were longer term commercial timber concessions. IPPK concessions were developed to allow communities to directly and sustainably manage their forests for multiple purposes. By contrast, HPH concessions, which were dominant prior to the advent of the IPPK community-based alternatives, focused more exclusively on timber for largely export-driven markets. The authors found that forest degradation was more severe and more rapid in IPPK concessions – an unintended and undesirable consequence. They make the case that the short term of IPPK concessions does not incentivize sustainable forest management. On the other hand, Kellert et al. (2000) suggest that centralized standards for the management of concessions – irrespective of their type – can help to ensure the sustainable management of resources. Moreover, merely recognizing local claims to land can have livelihood and justice benefits (Engel and Palmer 2006) by strengthening local peoples’ perceptions of how robust their *de facto* property rights (Kusters et al. 2007).

While not all scholars use these typologies explicitly, there is a large body of literature that underscores the importance of property rights in social-ecological systems. The importance of

property rights is increasing with the global emphasis on local natural resource governance for conservation. Efforts to graft global conservation initiatives onto local contexts requires a deep understanding of local property rights institutions, which are extremely diverse in their specification, enforcement, and formal legal statuses.

Li (2002) argues that the concept of a “community” is problematic, because so-called “communities” are rarely as homogeneous as they are presumed to be, and the term can easily diminish important power structures embedded within local spatiotemporal contexts. The result, according to Li, is an incongruence between local *de facto* property rights and rules-in-use for the resource, and the conceptions of local property rights that are built into management schemes and policies. The problems that are created by such incongruencies have been documented in a variety of contexts around the world. Blaikie (2006) elaborates that “communities” are typically understood to be spatially delineated, to represent a social structure, and to encompass shared social norms. These three elements of “community,” he argues, are rarely co-terminus. Pacheco et al. (2010) found that land tenure reforms in Bolivia, while well-intentioned to recognize the legitimacy of indigenous peoples’ historical claims to land, may actually give more power to timber companies and private firms. This is because old property rights systems have not been effectively dismantled, and there are still *de jure* titles and concessions held by private firms, some of which overlap with newly established indigenous territories. The result is a lack of institutional clarity, which can be exploited by more powerful actors to serve their interests at the expense of others. Kajembe et al. (2002) found that community-based forest management programs in Tanzania were easily compromised by external rules that were incompatible with local property rights. Clearly defined boundaries of access, withdrawal, and management rights - both within and between so-called “communities” - were associated with favorable livelihood

and resource sustainability outcomes. In Nepal, Ostrom (1994) found that clearly defined boundaries were of similarly great importance. Leon et al. (2011) came to a similar conclusion through a study of the Yuracaré community in Bolivia. Asquith et al. (2010) In Mexico, Klooster et al. (2000) argued that improvements to forest management in Mexico were the result of collective bargaining by local peoples to implement rules to share the benefits of forestry more equitably, and to mitigate the capture of benefits by elites.

The aforementioned studies show that that the process of institutional formation, and the specification and enforcement of property rights, are political processes imbued with a key characteristic of social-ecological systems that is often overlooked: power and politics. Agrawal (2003) eloquently explains the importance of power:

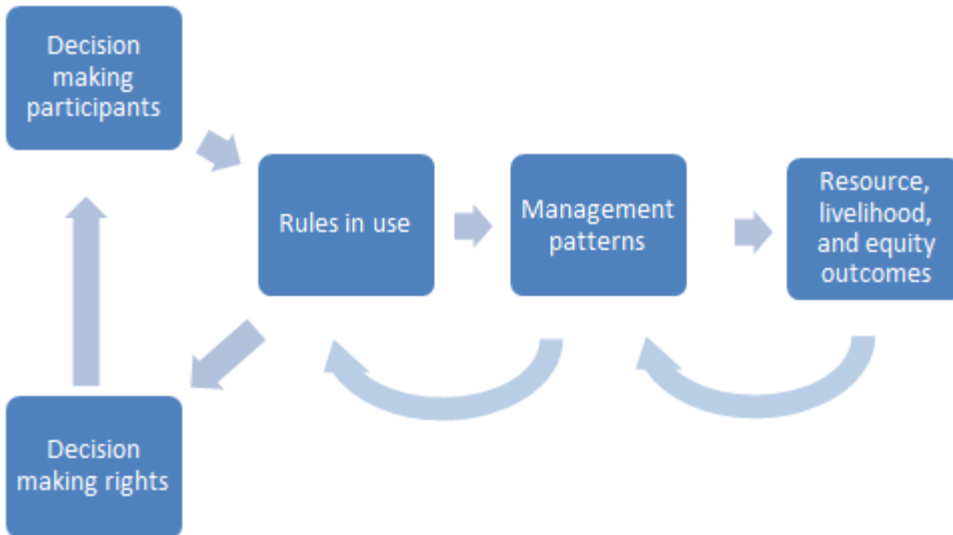
...power is not just what planning and management attempt to exclude. Rather, power and politics imbue the process of management thoroughly and unavoidably. Management is not just about providing technical solutions to objective problems of development and environmental conservation. It may be important to consider that these problems and their solutions may themselves be part of a political process. Without attention to the politics that generates underdevelopment and environmental degradation as universal problems, it may be impossible to address poverty, underdevelopment, and environmental degradation effectively.

Although power is complex, and has been defined variously by different groups of scholars, it can in general be understood simply by considering three questions: who benefits? who governs? and who wins? (Domhoff 1993) These questions can be asked at multiple scales and levels. For

example, in a country with centralized natural governance like Peru, it is clear that local communities do not govern; but can they still benefit? By contrast, in Bolivia, forest governance has undergone progressive decentralization over the past decade and a half. Local people therefore do, to a degree, govern; but do they also benefit? In both cases, who tends to win contentious political battles in important issue areas? Given that property rights that are specified but not enforced are not useful predictors of systemic outcomes, a particularly central question that underlies these concerns is are *de jure* property rights enforced through *de facto* and *de jure* institutions? These questions of power are broader than just property rights, and a full treatment of power in forest social-ecological systems is outside the scope of this study. However, these questions will be considered with respect to property rights specification and enforcement, and also of course elite capture of benefits. Both of these institutional arenas are affected by power and politics. Other scholars have emphasized the importance of power convincingly (e.g., Li (2002), Richards (2009)).

Overall, we can see that there are several elements of property rights that are absolutely central to shaping institutional outcomes in LGNR. It is important to consider (1) who holds what property rights, particularly with respect to management and decision making; (2) what rules-in-use govern resource use and future decision making; and (3) how those rights are specified and enforced. Figure 2.8 shows a schematic of this.

### **Figure 2.8 Rules-in-use, management rights, and LGNR outcomes**



Several examples from the literature are cited above that fit this schematic, but it is interesting to note that there is nothing approaching a consensus about these relationships. What rules-in-use, and management patterns produce the best outcomes? Who ought to make management decisions, and how should they do so? What are the best configurations of decision making rights? Ultimately, the literature on this subject produces more questions than answers about these questions. This dissertation uses data from Bolivia to examine these topics in further detail, with particular attention paid to the conditions that permit meaningful enforcement of *de jure* property rights in tropical forest systems.

### **Chapter 3 - Inequality and Heterogeneity as Determinants of Forest Governance Processes and Outcomes: A County-level Quantitative Study**

Inequality and heterogeneity are often grouped in the natural resource governance literature, but the reality is that they are distinct from each other, and moreover neither is itself monolithic.

While the literature has focused largely on income and wealth inequality, this empirical chapter makes the case that other types of inequality and heterogeneity must also be considered, and that

the relationships between these types of inequality and forest governance outcomes is complex. The literature suggests strongly that various types of inequality and heterogeneity can compromise the sustainable governance of natural resources by reducing the likelihood of successful collective action. Ultimately, a more holistic approach to inequality and heterogeneity is required if it is to be usefully linked to outcomes and processes in the governance of natural resources. Such an approach should consider income-based inequality; but it must also consider the degree to which the community of interest depends on a cash economy. It should consider wealth-based inequality too; but it must also consider carefully the degree to which wealth is related to power, and how asset-, institutional- and network-based inequalities are inter-related.

This chapter focuses on economic and land inequality using municipal data from Bolivia. Forest governance outcomes are assessed in relation to these forms of inequality. As conservation strategies are applied by communities, counties, national governments, and the international community, it is critical to understand how systems with inequality are likely to respond. It is therefore useful to assess how forest governance outcomes change in response to income and land inequality, especially as these types of inequality change over time.

This chapter is organized as follows. First, the theoretical and experimental literature is revisited to describe how inequality is expected to, and has been found to, influence natural resource governance regimes. The collective action framework is used as a model to consider how social capital and decision making is likely to change under conditions of land and economic inequality. Second, history of inequality in Bolivia is presented to contextualize the contemporary context, and discuss how land inequality has changed over time. Third, a formal game theoretic model is then presented to show mathematically how such effects may manifest

themselves in the collective action framework. Fourth, county level data is described and analyzed to show how income and land inequality can explain variation in a variety of forest governance outcomes including illegal logging, total incomes from forestry, and overall forest condition change. The findings suggest that economic and land-based inequality have different simple effects on forest outcomes, as the literature has suggested. More surprisingly, there appears to be moderation between community titling and income-based inequality with respect to forest degradation. Where more communities have formal titles to their lands, the estimated adverse relationship between inequality and forest degradation is reduced. Further avenues for research are finally presented, and taken up in subsequent chapters. Particular focus is given to further interactions between different types of inequality and heterogeneity, and how these interactions may manifest between the community and county levels of governance.

### **3.1 Inequality: Expectations for Forest Governance**

#### **3.1.1 Common Pool Resource Models**

Economic inequality as measured by income, expenditure, and assets, has been widely discussed for its potential to drive the governance of collectively managed resources. Prior to Elinor Ostrom and her colleagues' contributions to the field, three models held a dominant position across disciplines in conceptualizing the governance of common-pool resources (Ostrom 1990): the Tragedy of the Commons (Hardin 1967), the prisoners' dilemma (Campbell and Sowden 1985), and the collective action framework (Olson 1965). In all of these models, actors face a set of constraints on their behavior, and act according to the incentive structure they face. Inequality in the initial conditions would, then, be expected to change the behavior of individual actors in any of these frameworks, and consequently change the collective outcomes. These frameworks

are discussed in turn below, ending with a discussion of collective action. In this dissertation, collective action is treated as a proximate driver of natural resource system outcomes. It is therefore given particular attention in this section.

In the tragedy of the commons framework, as initially posited by Hardin, a group of sheep herders who share a pasture will overexploit the resource by grazing too many sheep because they stand to enjoy the entirety of the benefit from each additional sheep, but only incur a portion of the cost of the pasture's degradation. The prisoners' dilemma framework, a very simple game theoretic model demonstrating one instance of a Pareto Inferior equilibrium emerging, can be used to show how the tragedy of the commons can be the result of a simplified common pool resource management scenario. Ostrom (1990) shows this (Figure 3.1, below).

**Figure 3.1 The Tragedy of the Commons as a Prisoners' Dilemma**

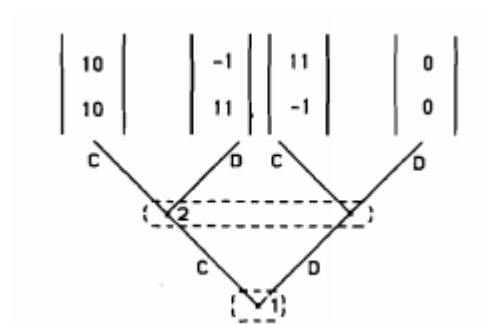


Figure 3.1 is read from the bottom up. Player 1 chooses to either cooperate (“C”) or defect (“D”), and then Player 2 makes the same choice. Cooperating, in Hardin’s scenario, would be agreeing to only graze a number of sheep  $x$  such that the total number of sheep on the pasture would equal the socially optimal level wherein both participants maximize their utility function – that is, until the marginal social cost is equal to the marginal social benefit. Defecting would entail grazing sheep until one’s marginal private cost of an additional sheep is equal to one’s marginal private benefit. If both participants defect, then the total costs associated with resource extraction reach a



point where the total benefit to each participant is zero. If both participants cooperate, a socially optimal outcome is achieved with the total net benefit from the resource maximized. The “tragedy,” or “dilemma,” is that rational actors will never cooperate. If Player 1 chooses to cooperate, then Player 2 must defect if she is rational (for a payoff of 11 units instead of 10); if Player 1 defects, then Player 2 must also defect if she is rational (for a payoff of 0 instead of -1). Player 1 finds herself in exactly the same position, and both will defect every time. While the particular payoff structure can vary – and most certainly does among the closest real-world approximations of this scenario – Hardin argued that the result was finally always the same. Rational actors would fail to engage in cooperative behavior in managing a common pool resource.

Many more sophisticated common pool resource games have been developed to model, and even test experimentally in the field, the behaviors of resource users under a variety of conditions. These conditions have included communication, repeated play, and the ability to sanction (Ostrom et al. 1992). However, only recently have scholars begun to use game theoretic models to consider asymmetric constraints in common-pool resources (Blanco et al. 2013). This is an important step, however, because asymmetries exist in the real world – different resource system users and user-groups face *distinct* incentives, and their behaviors are therefore not likely to be uniform.

Following the collective action framework initially proffered by Mancur Olson (1965), scholars have found that inequality can have adverse consequences for the governance of forest resources. Adhikari and Lovett (2006) argue that inequality can dis-incentivize collective action. The intuition behind this argument is that in a system where power and property rights are asymmetrically distributed, actors with the lesser initial endowment of different rights will have

no incentive to cooperatively use and manage a natural resource. Olson himself, on the other hand, argued that actors with a greater endowment will have an incentive to invest more in the sustainable management of the resource, even if other actors might free-ride to accrue benefits. Critically, these empirical and theoretical arguments do not necessarily suggest that outcomes will vary monotonically with inequality. Rather, they suggest that the *presence of inequality*, in terms of income, wealth, assets, and property rights, can qualitatively change actors' decision-making calculus.

### 3.1.2 Characterizing Inequality

In the context of forest governance, inequality and heterogeneity of multiple types have been shown to affect outcomes by hindering collective action<sup>7</sup>. The terms “inequality” and “heterogeneity” can be distinguished from each other, and moreover neither is monolithic (see Chapter 2 for a review of relevant literature).

As discussed above, economic inequality typically refers to commonly measured factors like income and expenditure, along with monetary wealth. However, other types of inequality, such as differential possession of land titles and tenure and the possession of assets that do not generate monetary benefits but are important for subsistence livelihoods, can be key drivers of forest governance outcomes as well. Collective action theory, a dominant paradigm in the study of social-ecological systems and natural resource governance, suggests that inequality can preclude the development of social capital, and consequently hinder effective and equitable collective decision making in the local governance of natural resources (Adhikari and Lovett

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<sup>7</sup> Some research has shown a U-shaped relationship between economic inequality and certain forest governance outcomes (Bardhan and Dayton-Johnson 2002), while other scholars have actually posited that the relationship may work in the opposite direction altogether (Olson 1965), although this view has found little empirical support.

2006; Ostrom 2000). Since the mechanism by which collective action may be compromised by economic inequality turns on social capital, it is reasonable to expect that where social capital is developed in one arena – such as conferring collective land titles to communities – the adverse effects of other types of inequality on forest governance outcomes may be lessened. The first empirical chapter tests hypotheses related to these concepts.

Economic inequality has been characterized as a type of group heterogeneity, in that where there is economic inequality, there is a heterogeneous distribution of economic resources. Other types of heterogeneity also exist, and have been found to drive forest governance outcomes. These include ethno-linguistic heterogeneity and sociocultural heterogeneity (e.g. Agrawal 2001; see Chapter 2 for further treatment of the literature surrounding heterogeneity).

Heterogeneity, like economic inequality, is therefore not monolithic. Moreover, the term “heterogeneity” can be considered to subsume economic inequality. In spite of these distinctions and overlaps, the concepts are closely linked through the collective action framework.

Scholarship of the local governance of natural resources have suggested that non-economic heterogeneities among forest users can also compromise effective collective action and forest governance outcomes (Varughese and Ostrom 2001; Adhikari and Lovett 2006). For this reason, both concepts are considered within the scope of this study. Non-economic heterogeneities are treated as potential drivers of social network formation, in particular.

In this chapter, two types of inequality (which can also be accurately considered ‘heterogeneities’) are examined in detail: (1) socioeconomic inequality, which includes inequality in wealth and income, and (2) land inequality, which refers to inequality in the distribution of land titles and other property rights. Apart from these, other heterogeneities can be

play an important role in shaping incentives and outcomes for collective action, including ethno-linguistic, gender-based, cultural, and religious heterogeneities. This chapter focuses on the first two types of inequality, while subsequent chapters explore other forms of inequality and heterogeneity. The models described above imply different impacts from these different types of inequality. One of the strongest papers on heterogeneity and inequality as drivers of natural resource governance outcomes (albeit focused on irrigation systems rather than forests) was conducted by Bardhan and Dayton-Johnson (2002). Bardhan and Dayton-Johnson have three central findings, which reflected new research and also a survey of myriad case study investigations that had been conducted prior to theirs. They found that:

1. Heterogeneity *in general* tends to have negative effects or no effect at all
2. Sociocultural heterogeneity compromises collective action by diminishing the effectiveness of social norms and social sanctions at promoting collective action
3. Economic heterogeneity has a negative effect on natural resource governance outcomes that is distinct from, but mechanistically linked with, social heterogeneity

Perez-Cirera and Lovett (2006) also produced a robust empirical study of power inequality, wherein they examined the links between intra-community power imbalances, asset based inequality, and cultural heterogeneities. They found that across 38 Mexican ejidos, heterogeneity and inequality had largely negative impacts. Economic inequality appeared to itself be exacerbated by other forms of heterogeneity, but it did not drive – independently, jointly, or interactively – forest condition outcomes or total income from the forestry sector. Because economic inequality is linked to social inequality, there are strong theoretical reasons to expect it to compromise collective action because poorer individuals will feel alienated from wealthier (and generally more powerful) individuals.

Looking at these findings, and the findings of others (outlined in more detail in Chapter 1), appears that the various types of heterogeneity and inequality have a complex and interactive effect on multiple forest governance outcomes. In particular, the role of economic inequality is poorly understood. Does economic inequality itself break down the social cohesion necessary for collective action to sustainably and equitably manage natural resource? Or is it merely a spurious indicator of other forms of heterogeneity that have this same effect? The relationships between these different forms of heterogeneity are central to this puzzle. Before presenting a model of how economic and land inequality may affect collective action outcomes, and testing these predictions using Bolivian municipal data, it is necessary to examine the particular history of inequality in Bolivia to see how, at the macro level, these forms of inequality and heterogeneity have emerged and evolved over time.

### **3.2 History of Inequality in Bolivia**

The Republic of Bolivia remains the poorest country in South America, with a very high percentage of indigenous people. The majority of Bolivians live in the highlands, with a minority inhabiting the tropical, forested lowlands which comprise most of Bolivia's land area. The total land area of Bolivia is 108 million hectares, roughly half of which is forested (Taylor 2006). Bolivia is divided into three principle regions: the Andes Mountains and dry *altiplano* in the west, the *yunga* tropical hill transition zone, and the eastern lowlands. People and forests in Bolivia are distributed counter to each other, with a much higher population density in the *altiplano* than in the humid eastern lowlands (USAID 2011). Bolivia has remained characterized by high socioeconomic inequality, with a Gini index of 56.3 as of 2008 (World Bank 2009), just slightly higher than neighboring Brazil (Gini 55.1) which is notorious for its unequal distribution of income and wealth. As of the most recent reliable information, which was collected around

2008, Bolivia maintained a level of inequality very similar to what it was prior to the rise of its populist and pro-indigenous president Evo Morales in 2006. While forest resources are abundant in Bolivia, they contributed less than 5% of its GDP in the 2000s (Taylor 2006). Between 2005 and 2010, the land area dedicated to legal timber production increased by 20%, from 31,760 ha. to 38,273 ha., although much of that area (13,100 ha.) is not actively harvested (ITTO 2011). Table 3.1 summarizes Bolivia's key national-level biophysical and socioeconomic attributes.

**Table 3.1 Bolivia Country Description**

	Year	Score
Population, total	2008	9,684,093
Population ages 0-14: 15-64: 65+ (% of total)	2008	36.7: 58.6: 4.7
Population growth (annual %)	2008	1.7
Rural population (% of total population)	2008	34.4
Population density (people per sq. km)	2008	8.9
Literacy rate, adult total (% of people ages 15 and above)	2007	90.7
Land area: Surface area (sq. km)	2008	1,084,380: 1,098,580
Arable land (% of land area)	2008	2.8
Agricultural land (% of land area)	2005	34.8
Permanent cropland (% of land area)	2005	0.2
Irrigated land (% of cropland)	2003	4.1
Forest area (% of land area)	2005	54.2
Nationally protected areas (% of total land area)	2006	20.2
Renewable internal freshwater resources per capita (cubic meters)	2007	31,891.8
Annual freshwater withdrawals, agriculture: domestic: industry (% of total freshwater withdrawal)	2007	80.6: 12.5: 6.9
Crop production index (1999-2001 = 100)	2005	120.1
Livestock production index (1999-2001 = 100)	2005	109.2
GDP (current US\$)	2008	16,674,278,562
GDP growth (annual %)	2008	6.1
Agriculture: industry: manufacturing: services, value added (% of GDP)	2008	13.6: 42.2: 15.6: 44.3
Ores and metals exports: imports (% of merchandise exports: imports)	2007	26.2: 0.8
Aid (% of GNI)	2007	3.7

*Source: World Bank, 2009*

Table adapted from USAID (2011)

In 1996, the Bolivian government passed a landmark agrarian land reform that created an institution (*Instituto Nacional de Reforma Agraria*, hereafter INRA) to deal with chronic issues of access to arable land. The law permitted local people to apply for land titles. However, the law was widely seen as ineffective and poorly implemented, with land transfers and titles for local people – especially indigenous lowlanders – plagued by bureaucratic red tape. Morales implemented another sweeping land-reform agenda shortly after coming to power in 2006 with the Law of Community-Based Redirection of Agrarian Reform (*la Ley de Reconducción Comunitaria de la Reforma Agraria*). The goal of this law was to ensure access to secure tenure, expedite land reform and distribution as per the goals of INRA, and prioritize the claims of indigenous peoples with traditional land claims (USAID 2011; Arias and Robles 2007). The spirit of these reforms was ultimately codified in the constitution of 2009. The constitution states that the lands of Bolivia are indivisible and inalienable property of the Bolivian people.

When Morales came into office, ten years after INRA was passed, only 7.38 million hectares had been titled under the stipulations of the reform. The process accelerated rapidly under Morales, with over 16 million hectares titled by 2009 (Parellada et al. 2010). The process has continued, and indigenous territories - most of which are contained within Original Community Territories (*Tierras Comunitarias de Origen*, hereafter TCOs). In spite of these reforms, arable lands in the eastern lowlands of Bolivia are still far from fully titled, and titling has been slower in these sparsely populated and indigenous lands. Large land-holdings by private elites remain widespread, and many farmers are still landless; while there are no current reliable estimates, 30% of farmers were landless as of 2007 (USAID 2011).

Landlessness as a manifestation of inequality has led to a cascade of social, political, and economic effects through several mechanisms. While a new political coalition was formed

during this time, geography came to dominate much of the political landscape instead of class and ethnicity, and this has important implications for inequality in the lowlands compared to the highlands.

Socially, popular awareness of landlessness has provided the impetus for further consolidation of the indigenous identity in Bolivia. The land reforms of Morales are a testament to this, and even the ineffectual INRA policy was the result of pressure from a united indigenous front (Klein 2011). This same group was responsible for Morales's election, and his administration's proactive pursuit of further titling for indigenous groups serves these groups.

Politically, the past decade has seen a reconfiguration of Bolivian politics, and the allocation of land rights has been central to this process. To understand the current situation, it is necessary to review briefly some salient elements of Bolivian history. Bolivian politics have been traditionally divided along geographic as well as ethnic axes. Indigenous people comprise 64% of the country's population, and the complex nature of the indigenous identity may obfuscate others who have indigenous roots, but do not identify principally with an indigenous community. Since the Spanish colonial era, whites and some elite mestizos were largely opposed to the indigenous population. Unlike in North America and other South American countries like Argentina, indigenous peoples were never exterminated or extirpated in large numbers, and they remained the majority group. Even prior to independence, resistance to white rule was strong, often culminating in armed rebellion.<sup>8</sup>

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<sup>8</sup> The history of indigenous rebellion in Bolivia (and the rest of the Andean region) is long and violent. Tupac Amarú rebelled against the *encomienda* as early as 1572, and was later executed. His legacy continued to inform indigenous identity and politics, so much so that future revolutionary including José Gabriel Condorcanqui took his name, calling himself Tupac Amarú II during his pan-Andean rebellion of 1780. Other rebel leaders like Tupac Katari



During the 19<sup>th</sup> and 20<sup>th</sup> centuries, Bolivia remained a very poor and unequal society, and this inequality manifested itself in living conditions as well as access to land. In 1952, Victor Paz Estenssoro led a successful armed revolution against the oligarchic and conservative government. In addition to instituting universal suffrage, rural education, and other relatively progressive programs, Estenssoro's government also instituted a land reform that was in principle, for the time, more radical than any of the changes that have been implemented in the 1990s or 2000s.

Prior to the revolution, Bolivian land tenure resembled feudalism far more than any other system. Wealthy land owner-creditors had a state-supported monopoly on land, and indigenous farmers worked for them as effectively indentured servants (Clark 1969). Estenssoro's reform in 1953 allowed peasants (who were largely indigenous) to stake claims to territories. This often went through tenuous official channels, but in other cases was catalyzed by peasant invasions of lands formerly held by wealthy land lords, who fled the countryside in large numbers during this time. In these cases, peasant claims to lands were inherently unstable; memories of landlord power and their recent feudalistic subjugation did not vanish with the implementation of the reform, and the new government's power – or even desire - to legitimately defend these new claims was at best uncertain.

Estenssoro was intermittently in power until 1964, and even when he held power, his Revolutionary Nationalist Movement party (*Movimiento Nacionalista Revolucionario*, hereafter MNR) was far from decidedly pro-peasant (Klein 2011). Landlords would use resources and

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continued to resist Spanish leadership, until Simón Bolívar (a wealthy white man himself) and others successfully established independence for the modern states of Bolivia, Ecuador, Peru, Colombia, and Venezuela. Klein's 2011 volume offers an excellent treatment of the overall economic, social, political, and cultural history of Bolivia.

networks to control state institutions of land titling, in addition to direct intimidation of peasants, to repossess their recently lost lands. As a result, many of the gains that peasants had made during the 1950s were rolled back within a decade; subsequently, Bolivia entered a decade and a half of very high instability, marked by a series of presidencies, coups, and military dictatorships. None of these governments demonstrated a meaningful interest in, or indeed the capability for, tackling the festering problem of land inequality.

In 1985, Estenssoro was elected for another term. While he had been sympathetic to left-wing politics earlier in his career, Estenssoro now changed his political course, appointing key people to his cabinet that would implement a structural adjustment agenda. These neo-liberal reforms in the 1980s and 1990s - including decentralization, deregulation, and privatization – precipitated concentrated resistance which manifested in the Land Reform of 1997 (Gill 2000). The failures of this reform to meaningfully change the perceived injustices of Bolivian land distribution, compounded with other perceived injustices perpetuated by the administration of Gonzálo “Goni” Sanchez de Lozada (1993-1997; 2002-2003)<sup>9</sup>, led an ever-more consolidated anti-globalization political movement, with indigenous people comprising its core constituency. This movement ultimately led to Morales’s election in 2006.

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<sup>9</sup> Sánchez presided over continued privatization policies with an orientation towards globalization. During the interim period between Sánchez’s two governments in 2000, violent protests erupted in Cochabamba over a proposed state contract with the San Francisco-based Bechtel Corporation – the 5<sup>th</sup> largest private corporation in the United States (Forbes 2011) – to privatize the municipal water supply. When Sánchez returned to power, the “Gas War” was precipitated as union leaders (including Evo Morales) vocally objected to the continued exploitation of Bolivian natural gas resources by multinational interests, as well as the undercapitalization of these resources by the state itself. In the *altiplano* city of El Alto, protests turned violent and 60 protestors were killed (Greenwald 2012). Sánchez, facing charges of genocide and crimes against humanity, was granted asylum in the United States.

The rearrangement of political interests that came with Morales's presidency maintained, to a great degree, the opposition between the white elite and the largely indigenous peasant class. While Morales ran as a champion of indigenous rights, not all indigenous peoples are part of his coalition. The majority of Bolivia's indigenous people are Quechua-Aymara speakers in the *altiplano*, including urban centers in the La Paz, Cochabamba, Potosí, and Oruro departments. The lowland indigenous people, on the other hand, do not universally perceive Morales as a champion for their own causes (Klein 2011). The stronghold of opposition to Morales is the Santa Cruz department, which is heavily forested and populated by a large number of indigenous communities. While the Morales government greatly accelerated land titling in Bolivia as a whole, it did so to a much lesser extent in the eastern lowlands, where the country's tropical forests lie. Thus, a new and somewhat tenuous coalition has formed that includes lowland indigenous people as well as, unprecedentedly, urban lowland elites.

Economically, land-based inequality has led to important migratory movements. Landless peasants from the lowlands have migrated to the cities to find work, as agriculture has continued to grow in scale and capital-intensiveness, reducing the sector's need for labor in the lowlands. On the other hand, migration has also occurred from the urban and semi-urban areas of the highlands to semi-urban and rural eastern lowlands, and this movement has been largely driven by now legal and highly lucrative coca production (Castillo and Durand 2008). The ethno-demographics of the lowlands have consequently shifted since Morales came to power (Poma 2008), and this may have preferentially altered income, wealth, land, and network-based inequality. There has been no rigorous study of how these political shifts and migratory movements have affected inequality to date. Nevertheless, inequality in its many manifestations varies substantially among departments, among provinces and counties, and among

communities. Critically, the presence of land inequality creates a mismatch between the people who live in forests, and the actors who own them.

A game theoretic model can be used to generate predictions of how actors will behave in systems with inequality. Inequality in property rights can be particularly important, because in many real-world systems, resource systems can have many users; some of these users may have use-rights, while others may have higher rights such as management, exclusion, and alienation.

### **3.3 Inequality as a Driver of Forestry Outcomes: A Game Theoretic Model**

It has been well established in the common pool resource game theory literature that in systems characterized by few players (Bergstrom 2010), repeated play, and communication, resource management strategies can be improved with respect to Nash equilibria<sup>10</sup> (Ostrom et al. 1992). While in real world systems, sanctions and fines are often applied, Ostrom et al. (1992) found, experimentally, that repeated communication – even without enforceable contracts – can yield equal or even better outcomes than a system where actors can sanction each other, with the best outcomes occurring in common pool resource games with repeated communication, no sanctions, and a low total resource endowment. Given the position that Bolivia is in now, with increasing *de jure* property rights for communities, it is useful to examine the outcomes that would be theoretically expected from such reductions in land-based inequality.

Despite the abundance of commons literature suggesting that inequality can play an important direct or indirect role in shaping outcomes in common pool resource systems, inequality has not

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<sup>10</sup> In game theory, a Nash equilibrium is the set of strategies that players will adopt given full knowledge of all players' available strategies and expected payoffs. These equilibria can be Pareto inferior to other sets of strategies, and there can be multiple equilibria in game.

been widely studied experimentally. Janssen et al. (2011) are an exception to this, having developed and tested experimentally a game theoretic model for irrigation systems, with upstream users extracting water prior to downstream users. However, inequality in forest systems – especially property rights inequality – manifests itself differently. Actors with a greater property rights endowment in forest systems do not extract before other users. Rather, they hold a monopoly on management, and in some cases use, and often have the capacity to exclude other users. This isolates non-owner forest users from legal access, and precludes them from participating in the development and deployment of sustainable forest management strategies.

A game theoretic model can be used to predict the behavior of actors in a realistic forest system in which some actors are owners, and others users. The model presented below is simplified to just two players – one forest ‘owner’ and one forest ‘user’ – although in any real forest system, there are certainly more than two actors. The model is still instructive as a tool for understanding some the mechanisms by which land rights inequality can alter actors’ behaviors, and consequently the outcomes for the forest system in general.

In order to realistically represent a forest system, seven assumptions are made. First, there are two types of actors – a titled forest owner, and a non-titled forest user. Second, extracting forest resources – generally timber, but other resources as well, although the distinction is immaterial for the purposes of this model – is beneficial; extracted units from the forest are fungible, and are treated as the total benefit that actors are trying to maximize. Third, the amount that any actor can extract is limited, and to is assumed to be proportional to the amount of forest resource present; this is a simplifying assumption, because economically recoverable reserves actually diminish more rapidly than the total available resource. Fourth, the forest owner values standing forest for reasons apart from its extractive value (she may receive payments from conservations

in the future, sustainably log it herself, or make a lucrative contract with a private firm or public entity to do so), and is therefore willing incur some short term cost to keep it from being completely degraded. Fifth, the cost of excluding forest users increases with the quantity of forest resource. Sixth, it is costly for the forest owner to monitor the forest and prevent the non-titled forest user from illegally extracting timber from the forest. Seventh, actors repeatedly make decisions about whether and how much to harvest from the forest, and in the case of the titled forest owner, whether to invest in exclusion. Finally, the forest regenerates slowly over time. The game is specified formally below. Table 3.2 (below) describes the symbols that are used in the game's description.

**Table 3.2 Description of Parameters in Game Theoretic Model**

Symbol	Meaning
$u_1$	The titled forest owner
$u_2$	The non-titled forest user
$h_1$	The titled forest owner's harvest level for a turn
$h_2$	The non-titled forest user's harvest level for a turn
$e$	A binary variable; 1 if the forest owner opts to pay to exclude the forest user, else 0
$f$	The forest stock at the beginning of a round.
$b_1$	The titled forest owner's stock of fungible forest/currency units at the beginning of a round
$b_2$	The non-titled forest user's stock of fungible forest/currency units at the beginning of a round
$x$	An index of the cost of exclusion that the titled forest owner must pay
$a$	The highest multiple of 10 greater than $f$ , to simplify the game for
$y$	An index of how much the titled forest owner values standing forest stock
$p$	The probability that a user extracting illegally will be caught and face penalty
$c$	The magnitude of the penalty that a user caught extracting illegally will face

A mathematical specification of this game follows. Because the system is complex, its specification is necessarily technical. Readers who do not wish to read the technical specifications of the game may skip to the following section, which outlines its implications.

The section that follows the specification of the game theoretic model summarizes its predictions and implications.

### 3.3.1 Mathematical Specification of the Game

The game can be defined in normal form as follows:

$$G = \{S_1, \dots, S_n; u_1, u_2\}$$

$S_1, \dots, S_n$  represents the set of available strategies to each player,  $u_1$  represents the payoff function for the property rights holding player, and  $u_2$  represents the payoff function for the other, non-property rights holding player. The strategy sets for each player are described subsequently in detail; note that they are very different for each player. Essentially, the formal-rights holding player (player 1) must choose a harvest level  $h_1 <$  and also  $e$ , a binary variable denoting exclusion of the other player. The non-formal rights holding player (player 2) simply chooses a harvest level,  $h_2$ . Each player begins with a stock of 10 trees (the units of the forest, and also a fungible currency in the game), and the forest itself begins with a stock of 50 trees; the current forest stock will hereafter be  $f$ . The players' stocks at the beginning of each round will be described as  $b_1$  and  $b_2$  respectively. The forest regenerates at a rate of  $r$  (this matters for the cooperative equilibrium, discussed at the end of this section).

Each round, the formal rights holder will go first, and she will have the option to harvest (her chosen harvest denoted by  $h_1$ ) up to 15% of the highest multiple of 10 greater than  $f$  (hereafter  $a$ , determined at the beginning of each round, and treated as constant for each round), and also to pay proportion  $x < .1$  of  $a$  to the bank to place an exclusion token on player  $u_2$  (e.g., if there are 50 trees in the forest as in the first round, she may harvest up to 5 trees, or pay  $x*50$  trees to the bank for an exclusion chip on the other player). Exclusion is represented by a binary variable  $e =$

1 if the formal rights holder pays to exclude the other player, and otherwise 0. Excluding the other player is attractive because of the forest owner values standing forest stock for its future benefits. The titled forest owner derives a benefit equal to proportion  $y$  of, so long as the **total** harvest ( $h_t$ ) is below  $y*a$ .

The non-formal rights holding player plays second, and will be aware of the action taken by the first player. She can choose to harvest (her harvest level will be denoted by  $h_2$ ) up to a maximum of 15% of the stock as well, irrespective of whether or not she has been excluded. If she has been excluded and chooses to harvest, she may be caught and forced to pay proportion  $c$  of the amount she attempted to harvest ( $h_2$ ), with probability  $p$  (if she is caught then  $d=1$ , otherwise  $d=0$ .)

Thus the expected payoff for the formal rights holder described in equation 4:

$$u_1(a,x,e,y,h_1,h_2) = h_1 + f(a,y,h_1,h_2) - a*e*x \text{ (Equation 4)}$$

where  $f(a,y,h_1,h_2)$  is the titled forest owner's payoff function for standing forest, described below in pseudo-code:

```
function  $f(a,y,h_1,h_2)$  {
    if  $((h_1+h_2) > (y*a))$  then return 0
    else return  $y*a$ 
}
```

The expected payoff for the non-formal rights holder is described below in pseudocode:

```
function  $u_2(e,d,c,h_2)$  {
```



```

if e=1 {
    if d=1 then return (- c*b2)
    else return h2
}
else return h2
}

```

Thus, if the player has not been excluded, the expected payoff is simply  $h_2$ .

If she has been excluded, then her expected payoff is expressed in Equation 5:

$$E(u_2|p, h_2) = p*(-c*h_2) + (1-p)*h_2 \text{ (Equation 5)}$$

The non-formal property rights holder's strategy set is simply how much she chooses to harvest, although her decision will depend on the value of  $e$ . The formal property rights holder's strategy set is how much to harvest, and also whether or not to pay the cost of exclusion. Both players seek to maximize their utility functions.

The derivative of Equation 5 with respect to  $h_2$  depends only upon  $p$  and  $c$ . Equation 6, below, shows the first-order derivative of Equation 5. Thus, these values will be varied across games to produce marginal benefits and costs that are, variously, marginally greater than or less than zero, so that varying levels of risk and reward for illegal harvesting are captured.

$$\frac{du_2}{dh_2} = -(c - 1)p + 1 \text{ (Equation 6)}$$

Setting the first order derivative equal to zero and solving for  $p$  reveals the point at which it is no longer worth harvesting illegally (Equation 7).

$$p = \frac{1}{1+c} \text{ (Equation 7)}$$

If the left side of this equation equals or exceeds the right (**case 1**), then the non-formal rights holder will never to harvest when excluded because the expected return for harvesting is less than or equal to zero. When the right side of the equation exceeds the left side (**case 2**) the player will always harvest illegally, up to the maximum amount allowed.

Given that the behavior of the non-formal rights holder is in theory determined by this relationship, the actions of the formal rights holder can be predicted as well. In case 1, the rights holder will always pay the cost of exclusion ( $x^*a$ ), and harvest as much as possible without exceeding the PES limit (i.e,  $h_I = y^*a$ ), knowing that the other player will not harvest illegally.

In case 2, the non-formal rights holder will always harvest 15% of  $a$ , the maximum allowed, irrespective of whether or not she is excluded. So long as  $h_I < y^*a$ , which is a reasonable assumption given that a higher level of harvesting would make it impossible to benefit any more than  $.15^*a$ , the expected payoff for the rights holding player, given that this behavior is known, is shown in Equation 8:

$$E(u_I|p,a,x,e,y,h_I) = h_I + p^*(y^*a) - a^*e^*x \text{ (Equation 8)}$$

Thus, if  $p^*y < x$ , then the player will simply harvest  $h_I = .15^*a$  and never pay the exclusion fee. Otherwise, she will pay the exclusion fee, and harvest  $h_I = y^*a$ .

From the above discussion, the three Nash equilibria have been determined, and they depend on the values of  $p$ ,  $c$ ,  $x$ , and  $y$ . Table 4 describes these equilibrium expected payoffs and strategies:

**Table 3.3 Nash Equilibria for Two-person game**

<b>Equilibrium strategies</b>		
Case 1: $p \geq \frac{1}{1+c}$	Titled forest owner benefit: $2*(y*a) - e*x*a$ $\{h_1=y*a; e=1\}$  Non-titled forest user benefit: $0 \{h_2 = 0\}$	
Case 2: $p < \frac{1}{1+c}$	If $p*y < x$ (situation A):  Titled forest owner benefit: $h_1 = .15*a$  Non-titled forest user benefit: $h_2 = .15*a$	If $p*y \geq x$ (situation B):  Titled forest owner benefit: $y*a + p*(y*a) - a*e*x$ $\{h_1=y*a; e=1\}$  Non-titled forest user benefit: $(1-p)*.15*a - p*c*.15*a$ $\{h_2 = .15*a\}$

Cooperative equilibrium, on the other hand, would involve benefit sharing and mutual trust. In cooperative equilibrium, both players would harvest in such a way as to ensure that the PES payment is made; the benefit would be shared between both parties.

In case 1 and in case 2's situation A, above, there is no possible Pareto improvement that can be made. In case 2, situation B, however, a Pareto improvement can be made for any relationship between  $p$ ,  $x$ , and  $y$ . If the parties would agree to harvest a total of  $a*y$ , the total payoff  $u_t = 2*a*y$ . This sum can be divided so as to benefit both parties.

### 3.3.2 Predictions and Implications of the Game Theoretic Model

The Nash equilibria predicted by the model are Pareto inferior to a possible cooperative equilibrium, and could be improved upon through robust and enforceable benefit sharing

arrangements. This “cooperative equilibrium” that reflects successful collective action would benefit all parties. Rather than incurring costs to exclude non-titled forest users, forest owners and users could instead agree to a sustainable harvest level; who exactly does this harvesting is immaterial if contracts (formal or informal) are well-specified and enforced (Coase 1960). The benefits from this arrangement could be shared among actors, saving the titled forest owner costs from monitoring and enforcement, and saving the non-titled forest users the costs associated with the risk of being sanctioned for an illegal harvest. These costs are incurred in the Nash equilibria, to varying degrees depending on the system’s parameters (see Table 3.3 above). Economic inequality is expected to reduce the likelihood of cooperation, because it compromises the effectiveness of social sanctions and social capital in promoting collective action (Varughese and Ostrom 2001).

This model of collective action produces the following hypotheses:

H1: Where income and land inequality are greater, users are less likely to cooperate with rules, and more likely to extract forest resources outside the bounds of legal constraints.

H3: Forest degradation will be greater in general when inequality in land and income is greater, due in part to illegal extraction, but also as a result of failures in collective action.

H4: The social capital produced by land inequality may “make up for” some of the adverse social consequences produced by income inequality, with each type of inequality moderating the others’ effect on forest condition change.

### **3.4 Municipal Data and Variables**

Studies of inequality have been conducted at a variety of scales, including community, regional, and national. In Bolivia (and indeed elsewhere in Latin America) the two primary sources of household-level socioeconomic data are national censuses and community-level household surveys. Researchers from a variety of disciplines have conducted household surveys that capture basic economic data, and communities are typically the unit of analysis in these cases (Arias and Robles 2007). While income is occasionally surveyed in censuses, expenditures are generally not. Data on Bolivian household expenditure and inequality data at the county level has not been systematically collected. To deal with this, scholars from the World Bank modeled household expenditure using data from in community-level household surveys against other socioeconomic variables collected by in the 2001 census (Arias and Robles 2007), and then imputed household expenditure data at the county level using the hedonic poverty estimation approach outlined by Elbers et al (2003). Household expenditure data from 2001 was then used to calculate the Theil indices of inequality<sup>11</sup>.

This data was combined with municipal survey data from Bolivia carried out in two rounds – 50 counties were surveyed in 2001, and again in 2007. In both 2001 and 2007, two data sources were used: interviews with top officials from Municipal Forestry Units (*Unidades Forestales Municipales*, or UFM), and interviews with top officials from local oversight committees (*Comités de Vigilancia*, or CVs). The data was collected as part of a SANREM (Sustainable

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<sup>11</sup> The Theil index of inequality is derived from information theory, and is calculated as two special cases Generalized Entropy Index; one weights inequality among lower-income households more, and the other gives more weight to inequality among higher-income households. Compared to the Gini index, the Theil index is more robust to many different levels of aggregation. For a full treatment and derivation of the Theil indices, see Conceição and Ferreira 2000

Agriculture and Natural Resource Management) Bolivia project focused on forest governance, with support from the National Science Foundation<sup>12</sup>.

### **3.4.1 Independent Variables and Controls**

Data was collected on over 250 quantitative and qualitative variables across the four municipal surveys. The purpose of the initial data collection was broadly focused on the impact of decentralization on forest governance. As a result, much of the data pertains directly to formal and informal forest governance institutions, interactions between local people and official organizations, and multi-level management arrangements. Moreover, economic inequality was imputed using census data from 2001, along with community-level survey data collected at a variety of time periods. These estimates are nevertheless robust, and are used because forest governance evolved over the course of the study period (2001 – 2007), and conditions in 2001 are necessarily linked to conditions in 2007. No time series analysis was necessary, however, because all variables were only collected at a particular time. Given the large number of variables collected, data for all of them was not available in every county. Nevertheless, the overall number of missing data points is low across relevant variables, and regression models that contained many variables still produced estimates based on greater than 30 observations.

These variables can be classified into several categories: (1) demographic, (2) socioeconomic, (3) forest institutions, (4) land use, and (5) governance. Inequality, the characteristic central to this study, is a socioeconomic variable. These independent variables are described below (Table 3.4). A subset of these variables was used to model each of the outcomes of interest. The

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<sup>12</sup> Grant #SES-648447

variables were selected for each model to maximize consistency with the theory outlined above and in Chapter 1, and to optimally specify each model.

**Table 3.4 Independent Variables Used in Analyses**

Variable	Obs	Mean	Std. Dev.	Min	Max
Theil Index (S)	48	0.1896979	0.618682	0.0905	0.3325
Municipal Population	48	43775.08	162522.4	740	1135526
Number of Communities that Extract Timber	43	13.37209	21.5252	0	100
% communities with logging permits	43	24.86047	36.72263	0	100
% communities with titles	41	57.26829	34.11307	0	100
% of income reinvested in forestry	43	42.83721	45.50454	0	100
% of municipal land cover: agriculture	43	32.16279	21.09494	2	75
% of municipal land: forest	43	42.60233	66.74914	2	440
Logged Per Capita Forestry Income	43	-0.94799	2.901251	6.03488	3.5998
Number employed in the forestry sector	44	14.79545	61.89473	0	400

Interaction terms were constructed between the different types of inequality, because increases in social capital from one process – such as economic homogeneity – may be expected based on the theory and literature discussed above to moderate the adverse effects of other types of heterogeneity, such as land inequality, on collective action outputs and forest governance outcomes. To construct these interactions, the interacting variables were centered (by subtracting the mean) prior to being multiplied in order to reduce multi-collinearities in the resultant models and theory discussed above to. Other variables were used at various stages of analysis, but are not present in the models described below because they resulted in over-specification and reduced the overall fit of all models. These included municipal poverty (measured as mean household expenditure), perceived corruption (an ordinal variable), and conflict.

### 3.4.2 Dependent Variables

Two key forest governance outcome variables were measured in this dataset –changes in illegal logging (reflective of non-cooperative resource use decision-making), and change in the forest condition, which is indicative of the system-level outcomes of forest governance.

Forest condition change between (approximately 2002 and 2006) was reported in the 2007 UFM survey as an ordinal ranking from having been degraded severely to having improved considerably in the past 5 years. The values of the variable ranged from ‘5’ (high degradation) to ‘1’ (large improvement in forest condition), reported by the respondents.

**Table 3.5 Dependent Variables Used in Analysis**

Variable	Obs	Mean	Std. Dev.	Min	Max
Forest Condition Change ('02-'07)	40	1.85	1.051251	1	5
Total Forestry Income	43	58950.6	113422.6	36.5	500000
Change in Illegal Logging ('02-'07')	41	3.04878	1.548406	1	5

A number of counties reported no income from the forestry sector. These counties were not included in the analysis. Two separate models were run wherein counties that reported zero forestry sector income were assumed to have a very small forestry sector income (1 Boliviano, or  $1/n$  Bolivianos where  $n$  is the municipal population), in order to increase the number of observations in the model and include near-zero incomes in the results. However, the model did not gain any power from this transformation. Thus, these zero-income counties were simply omitted because there is no well-established, robust, and theoretically valid approach to log-transforming zeroes; moreover, when the same models were run using the adjusted logged incomes, the residuals were non-normal, violating a key assumption of OLS (Shapiro-Wilk  $p < 0.05$ ).



In all cases, independent variables that resulted in over-specification were removed as they served only to suppress other meaningful effects. This is the reason for the slight differences across the models that were ultimately selected for each dependent variable. In addition, models were run with square-terms for both land-based and income inequality, in order to test for U-shaped effects that have been hypothesized by various scholars. These models are not presented, as no U-shaped effects were detected.

### 3.5 Results from Municipal Analysis

#### 3.5.1 Forest Condition Change

Table 3.6 summarizes the results of the regression analysis on the ordinal variable ‘forest condition change ’02-’07.’ With all independent variables included, 28% of the variation in forest degradation is explained.

**Table 3.6 Forest Condition Change Linear Interactive Regression Model**

Independent Variable	Forest Condition Change (’02-’07)	
	Coefficient	(SE)
Inequality (Theil S Index)	7.272	(5.59)
%communities titled	0.030	(0.015)*
Inequality * %communities titled	-0.176	(0.078)**
Population	0.000	(0.000)
Log(Income from Forestry)	-0.120	(0.071)
Number of Communities that Extract Timber	-.008	(0.008)
Intercept	1.486	(1.513)

<i>Adj. R</i> <sup>2</sup>	0.29
<i>N</i>	36
<i>P &gt; F</i>	0.03

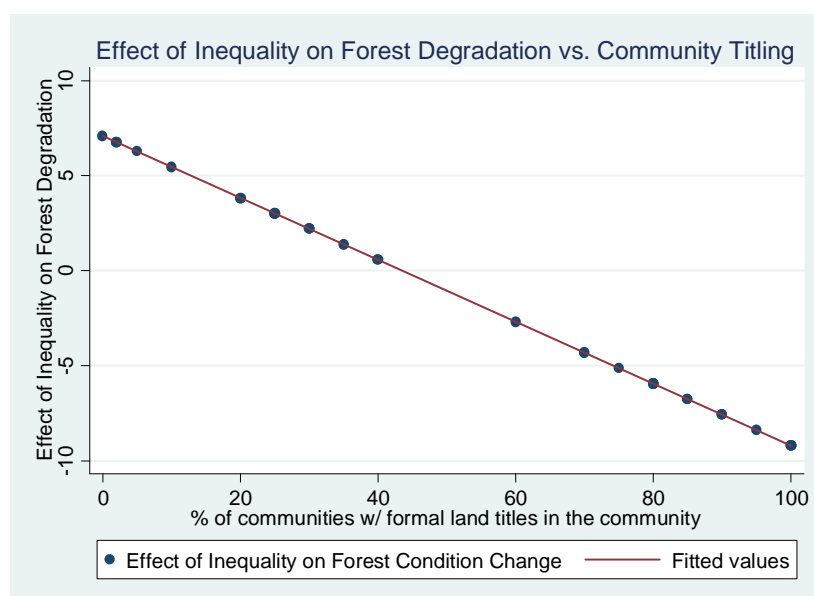
Legend: \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

The residuals from this regression were close to normally distributed and homoscedastic with respect to the dependent variable (White test for heteroscedasticity  $p > 0.05$ ; Shapiro-Wilk test for normality  $p > 0.05$ ). Robust standard errors were therefore not required, and the test statistics from the OLS regression could be interpreted without any modification.

Inequality does not have a simple effect on forest condition change as reported in 2007 ( $p > 0.05$ ). However, an interactive model with both community land titling – measured as the percentage of communities in a county with formal land titles – shows a different picture. While the average effect of income inequality is zero across all observations, the significant interaction reveals moderation of its effect by titling. A corollary of this significant interaction effect is that the effect of titling on forest condition change depends on the level of income inequality. Figure 3.7, below, shows the effect of each variable as a function of the other. Notably, the estimated effects of both income inequality and community land titling cross the zero mark near the median value of the interacting variable. Thus, the estimated effect of inequality on forest condition change is zero when 43.5% (the median is 40%) of communities in a county are titled; and the estimated effect of community titling on forest condition change is zero when the Theil (S) index is equal to 0.162 (the median is 0.177). Thus, the sign of the effect of inequality reverses at roughly the median value of community titling, and the sign of the effect of community titling reverses at roughly the median value of municipal inequality.

Note that the Theil index has a lower limit of zero, which represents perfect equality, and increases with inequality<sup>13</sup>. Forest condition was measured as an ordinal variables with ‘1’ corresponding to forests having improved the most, and ‘5’ corresponding to forests having been degraded the most. Thus, the interpretation of Figure 3.7 is that when very few communities have formal titles to land, income inequality is strongly associated with forest degradation; when many communities have formal titles, income inequality is actually associated with forest condition *improvement*. The obverse of this is that when inequality is very high, the

**Figure 3.7 Effects of Economic Inequality on Forest Condition Change**



### 3.5.2 Change in Illegal Logging

Changes in illegal logging between 2002 and 2007 are explained by a variety of factors. Table 3.8 presents the findings from a multiple regression model. In this model, as in the previous two, the residuals were normal and homoscedastic with respect to the outcome variable, so OLS

<sup>13</sup> To be precise, it increases as smaller shares of the population have more of the income; to this degree, it is similar to the Gini index.

coefficients and standard errors were used. No interaction effects were found in this case, and interaction terms resulted in over-specification and were consequently dropped from the model below.

**Table 3.8 Changes in Illegal Logging Regression Model**

Independent Variable	Change in Illegal Logging ('02-'07)
Inequality (Theil S Index)	9.424 (2.93)**
Population	-0.000 (2.92)**
Log (Income from Forestry)	-0.070 (0.96)
% municipal land cover: forest	0.026 (2.75)*
# communities extracting timber	0.036 (3.78)**
% communities with logging permits	-0.022 (3.16)**
% communities titled	0.010 (1.97)
Intercept	0.840 (1.17)
<i>Adj. R</i> <sup>2</sup>	0.42
<i>N</i>	36

\*  $p < 0.05$ ; \*\*  $p < 0.01$

Income inequality exhibited a strong and statistically significant association with increases in illegal logging during the period of study. In general, more populous counties had less illegal logging. The proportion of communities with formal titles was not significantly associated with illegal logging; however, counties where more communities had logging *permits* exhibited less illegal logging. However, the more communities that engaged in timber extraction in general, the

more illegal logging increased. Overall, 42% of the variation in change in illegal logging between 2002 and 2007 was explained by this model.

### **3.8 Discussion**

The municipal analysis has several important and novel implications. The theoretical model that informed this municipal study suggested that (1) economic inequality is associated with forest degradation because it produces collective action failures, (2) these collective action failures reduce the total (Pareto) benefits derived from the forestry sector, and (3) that the collective action failures that lead to outcomes (1) and (2) will also lead to more illegal extraction of forest resources. A discussion of these results in the context of these predictions follows.

#### **3.8.1 – Illegal Logging**

Illegal logging was explained by a number of factors, including income inequality. In counties with more income inequality, illegal logging was exacerbated significantly more than in counties with more equitable income distributions between 2002 and 2007. This finding is consistent with hypotheses generated by the literature, which suggest that collective action can be compromised by economic inequality. Where economic inequality is high, social cohesion can break down and cooperation in forest management can be elusive.

The interplay between land titling, permitted community forestry, and illegal logging presents some puzzles and insights as well. The percentage of communities within a county with legal titles to land did not have any effect on the change in illegal logging. One limitation of this analysis is that reported *changes* in illegal logging were measured, and absolute levels were not. Because of the nature of illegal logging, data on its prevalence is scarce to non-existent in

Bolivia. Thus, there may be an unobservable confounding factor that is related to both the changes in illegal logging and also titling; indeed, the absolute level of illegal logging seems to be a likely candidate. Counties with extremely high or extremely low absolute levels of illegal logging are constrained with respect to the ordinal ‘change in illegal logging’ value that they can take on – places with very high levels of illegal logging may not have much room to get worse, and places with extremely low levels may not be able to improve much. Conversely, where absolute levels of illegal logging were already very high in 2002, a stable equilibrium may have been achieved with respect to collective action – individuals and groups engaged in illegal logging were already benefiting from forests, and consequently saw no need to demand formal titles. Where illegal logging was low, non-beneficiaries of the forestry sector may well have seen an opportunity to benefit from local resources, and demanding formal titles from the government – especially after Morales came to power, and land inequality began to seem more tractable to peasants – may have been more attractive.

The game theoretic model presented previously shows that under conditions of land inequality, wherein some actors face a decision to harvest timber or not, they will illegally harvest if the probability of getting caught is less than  $1 / (1 + c)$  where  $c$  is the magnitude of the penalty they will face if caught. Thus, illegal logging is expected to occur when land titles do not exist, assuming that monitoring is relatively ineffective. Even if monitoring is more effective, it can be offset by insufficient penalties to produce illegal logging anyway. That changes in illegal logging have no observed simple or indirect relationship with titling (a measure of land inequality), one possible explanation emerges. Monitoring effectiveness and sanction magnitudes for illegal logging may simply be too low, across the country to meaningfully drive illegal logging. Other factors, especially market conditions, would be expected to dominate the effects in these

situations. Unfortunately, reliable data on the exact magnitudes of illegal logging, and even the frequency with which illegal logging operations are caught and sanctioned by authorities, are not available. This presents a further avenue of study for understanding illegal logging as an output of institutional arrangements, and also as a contributor – or non-contributor – to overall changes in the condition of Bolivian forests.

While formal titles didn't display any association with changes in illegal logging, logging permits did. This association was positive – the higher the percentage of communities with extraction permits, the less illegal logging increased between 2002 and 2007. While the Bolivian governments do not maintain accessible records of all logging permits in all regions – particularly not at the community level – it can be presumed, based on recent developments in Bolivian national politics with the ascent of Morales in 2006 (Pacheco 2011) that many permits were granted recently, and these new permits may have had an effect on logging networks, illegal and legal. While it may seem superficially tautological that permitting the extraction of timber will reduce illegal extraction, this relationship is actually not a foregone conclusion.

The Indonesian case provides a useful example of how providing avenues for permitting does not necessarily reduce illegal logging. Illegal logging has been better studied in Indonesia than most other places, and it is an instructive case for understanding the relationship between legal reforms and illegal logging. The abundant tropical forests of Indonesia underwent dramatic reconfigurations of governance after the fall of the Suharto dictatorship in 1998. Decentralization led to local authorities gaining considerable power; but even as some communities gained logging permits, illegal logging continued to persist through extensive networks (McCarthy 2002). During Suharto's tenure, many forests were reclassified as "production forests" – as much as 39% of forested land in Sumatra, for example (McCarthy 2002; Engel and Palmer 2008) –

while other lands were semi-protected or removed from production. Virtually all legal logging during this time was undertaken by firms with connections in Jakarta, who were able to secure 20 year logging concessions, to the near perfect exclusion of local people. Resistance to these firms' exploitation was common, and there was resentment among communities (Palmer 2001; McCarthy 2002). In addition, local entrepreneurs who had some access to physical and human capital, but not the connections in Jakarta necessary to secure logging permits, found it easier to simply pay off local officials to look other way while they extracted timber and sold it through illegal logging networks. These networks were thus strengthened, and local entrepreneurs were incentivized to harvest by simply lowering the risk of being caught and incurring sanctions associated with illegal harvest. Thus, legal extraction through powerful concessions co-existed with illegal logging networks. Membership in these networks appeared to perpetuate inequality even as other institutions changed form. The role of these networks in advancing power disparities and elite capture in forestry has not been well studied. The subsequent chapter revisits network-based inequality in Bolivian communities, where similar networks exist and shape local forest governance outcomes.

The decentralization reforms of Indonesia allowed local authorities to consolidate power, and provided some *de jure* mechanisms for communities themselves to secure logging permits. This didn't, however, change the fundamental calculus of the local loggers. As local authorities became more powerful, it actually became clearer in many instances how to continue logging illegally. Illegal logging networks, by this time, were already well established, and in many ways more attractive than legal channels. Costly negotiations with business partners and buyers had already been done in some cases, and actors could also avoid spending time securing costly permits. Thus, illegal logging was not strongly disincentivized by the provision of logging



permits. Communities did, in some cases, obtain permits in Indonesia. However, there is no evidence that this curtailed the illegal logging networks, which remained lucrative and active well after decentralization and forestry reforms in permitting and concession law (McCarthy 2002; Engel and Palmer 2008). Moreover, in Indonesia, having a “permit” does not always imply that all actors will consider permit-holders’ extractive activities to be legal. In some cases, trucks operated by local entrepreneurs involved in extraction would simply pay guards to issue permits as they left the forest with illegally removed timber (Kaimowitz 2003). Thus, being connected to illegal logging networks led to *de facto* access to benefits from timber for network members.

In Bolivia, illegal logging networks are quite common (Boscolo and Vargas del Rio 2007), but remain poorly studied with conflicting estimates surrounding its overall magnitude. Boscolo and Vargas del Rio (2007) assessed the impacts of the 1990s and 2000s forestry reforms on rural livelihoods in general, but were not able to directly assess illegal logging due to the lack of reliable data. The results of the analysis above suggest that in Bolivia as a whole, unlike in other contexts, the permitting process has, to at least some degree, worked. Communities have secured permits, and have likely extracted timber in areas where they are permitted to do so. The forest condition change analysis (discussed below) sheds light on how this dynamic may affect the overall resources sustainability of the forest – but reductions in illegal logging through effective permitting can, it seems, effectively reduce illegal logging. This presents an important avenue for in depth comparative analysis in the future; the largely messy Indonesian context should be rigorously compared to cases like Bolivia, so that the institutional determinants of successful versus less successful timber extraction permitting regimes can be better understood and used to inform future decision making.

The results above show that, controlling for other parameters in the model including permitting, counties where *more* communities extract timber have seen greater increases in illegal logging.

The implication is that robust permitting regimes may be critical mechanisms for reducing illegal logging when many actors are using a forest; the degree to which permitting and making illegal logging “legal” on paper is a legitimate approach to improving livelihoods and promoting sustainable resource use is, however, a separate question, which is treated now in the context of the other two analyses. Economic inequality is central to this issue, because even when a legal architecture to promote the legitimate and planned extraction of forest resources is present, income inequality can severely break down actors’ incentives to cooperate, and compromise the effectiveness of social cohesion and sanctions in driving collective action outcomes.

### **3.8.2 Forest Condition Change**

Looking to the forest condition change analysis, a very interesting picture emerges that links the different types of inequality under study. The results suggest that economic inequality does not have a simple negative effect on forest condition change. Rather, this effect is **moderated by land inequality**. The only seminal study that has taken into account many dimensions of inequality as drivers of outcomes in forest systems has been Bardhan and Dayton-Johnson (2002). Their study constructed multiple measures of inequality that described the concept of power inequality. Economic inequality, in their study, was largely treated as a systemic *output* rather than an input or an outcome. However, economic inequality can be justifiably expected to compromise collective action. If a region with forest resource is bifurcated between the resource-poor and the resource-rich, then the collective action model would suggest that social norms and sanctions that might produce incentives for sustainable resource management will break down; poorer actors will not be inclined to sustainably manage a resource because wealthier actors have

stand to invest more capital in the exploitation of the resource in the future, which may preclude them (the poorer actors) from deriving benefits from the resource in the future (Baland and Platteau 1999; Bardhan and Dayton-Johnson 2002; Adhikari 2003).

The results of this analysis, however, show that this effect does not occur in all cases. Rather, formal community titling has a strong moderating effect on the effect of economic inequality. The degree which communities have formal titles in Bolivia is indicative of land equality. Since the passage of INRA in 1996, communities have slowly been granted titles to land. This process accelerated rapidly since 2006 when Evo Morales came to power, and these results shed light on how these changes are likely to affect forest governance outcomes at the county level.

The results of the municipal analysis presented above do not, on their own, explain the *mechanism* behind the interaction between income and land inequality. However, they produce several further insights. First, the mutually moderating effect between income and land inequality, which is significant when considering forest condition change, does not appear to hold when considering total income from forestry or changes in illegal logging. The collective action model described above suggests that illegal logging would be an important mechanism that drives forest degradation, and compromises sustainable management. The lack of an interaction between income and land inequality with respect to illegal logging – and also forestry incomes - suggests that the mechanism by which land titling moderates the adverse effects of income inequality on forest condition change does not depend on illegal activities. This mechanism also may not be reflected in incomes from the forestry sector; thus, the interaction may come to a head in the collective action arena.

Table 3.9 summarizes the effects of key variables on the outcome variables described to this point, so that further discussion can more succinctly treat the system in an integrated fashion:

**Table 3.9 – Relationships Between Key Variables**

	<b>Illegal Logging</b>	<b>Forest Condition Change (Degradation)</b>
<b>Income Inequality</b>	+	+ / -
<b>Land Inequality (titling)</b>	/	- / +
<b>Logging Permits</b>	-	/

**+ : increase   - : decrease   / : no effect   +/- : moderated effect with variable direction**

Logging permits as a variable was included because they lent substantial power to these models, and also comprise a secondary measure of land inequality. Given that forests can be degraded through a variety of mechanisms – principally agricultural conversion and timber extraction, including legal and illegal logging – there are implicit connections between these outcome variables. The interaction between income and land inequality observed in the overall forest condition change is not present with respect to the other outcome variables. Thus, some other mechanism is likely at work. There at least three possibilities.

First, where communities don't have titles, economic inequality can incentivize small-scale degradation by poorer individuals on one hand to supplement their livelihoods. Non-timber forest products, firewood, and small construction materials can be more important for poorer households (Byron and Arnold 1999). Communities that do not have titles may not only lack access to forest resources, but also to agricultural land. Indeed the provision of secure agricultural land tenure was the principal motivation for the INRA land reform of 1996, and for

the acceleration of titling under Morales. Thus, land inequality – wherein communities and their constituent households lack secure property rights over arable land – is very likely to even further increase the dependency of households on forest products. This relationship between insecure land tenure and poor households' dependence on forest products has been well studied around the world (Belcher et al 2005; Angelsen and Wunder 2003; Sunderlin et al. 2005; Grieg-Gran et al. 2005). The literature suggests, however, that this type of forest degradation should increase with poverty, and not just inequality; however, this municipal data provided no evidence for a relationship between poverty as measured by household expenditures and forest condition change. Simple and interactive models that included poverty and its interaction with land inequality resulted in a reduction in the overall fit of the model, and no significant relationship was present in the data. The implication is that while this phenomenon may be occurring, the data does not provide support for the hypothesis that it is a primary driver of changes in forest condition. Moreover, as forests become further degraded, poorer households, who are already dependent on forest resources for lack of stable alternative livelihoods, can become further strained and vulnerable to economic shocks and perturbations.

Because poverty doesn't explain the interactive effect of income and land inequality on forest change, another explanation emerges. Small scale subsistence extraction by communities, while potentially important depending on the system, is rarely the principal driver of forest condition variability<sup>14</sup>. The existence of high economic inequality suggests that elite groups exist, and in

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<sup>14</sup> The study of the drivers of forest condition variability, deforestation, and forest degradation is itself complex area of study. Factors that would not be considered "institutional" - especially commodity prices – are effective at explaining large amounts of this variability (Manson and Evans 2007; Angelsen 2009; Rudel et al. 2009). This study, and this field of study, focuses on institutions because of their capacity to serve as proximate mediators and moderators of larger underlying drivers of forest condition variability.

Bolivia (as elsewhere) these elites tend to control the most lucrative economies in the forestry sector (Pacheco 2005). Poorer groups, under conditions of economic inequality, are not only largely excluded from timber extraction as an industry; they also lack any recourse to control the degradation of the forests by forestry elites. Formal titles provide a mechanism to challenge firms and other actors engaged in deforestation and forest degradation. When these titles are present, poorer actors are empowered to control land themselves and often to make sustainable management plans. While the existence of formal titles for forest communities is not a sufficient condition to ensure the sustainable management of land, it does facilitate it even when economic inequality is high and elites can exist. In other words, formal land titles may provide an important avenue for communities –even poor ones – to assert their claims to forest lands, and this appears to affect overall changes in the condition of the forest.

A final pathway through which the interaction between income and land inequality may manifest in forest condition changes involves multiple levels of governance. Given that the data analyzed above was aggregated at the county level, it is important to consider how communities themselves are relevant arenas of action in the governance of forests. In particular, heterogeneities and inequalities *within* communities are not effectively captured by this dataset, and there are theoretical reasons to expect that intra-community economic and inequality, sociocultural heterogeneity, and even land inequality may present problems for the sustainable management of forests. In Bolivia communities with formal titles under the stipulations of INRA are ostensibly autonomous, indivisible, and inalienable. An implicit assumption is that all members of the community are democratic stakeholders in the governance of their land, including forests. The *de facto* reality, however, can be more complex. The following chapter examines via a comparative case study the mechanisms through which intra-community

inequality and heterogeneity might drive this interaction between land and income inequality, and argues that aggregate municipal data, such as that analyzed in this section, produces results that cannot be fully understood without zooming in further to examine communities themselves.

### 3.9 Conclusion

The findings of this county-level analysis can be summarized as follows:

1. Income inequality may compromise forest governance outcomes, and is associated with lower net income from forestry and higher illegal logging
2. Land titling itself does not automatically reduce illegal logging, nor does it lead to higher net income from forestry.
3. When communities have logging permits, but not necessarily formal land titles, illegal logging may be reduced net incomes from forestry may increase. However, the overall change in the condition of the forest is not well explained by these phenomena.
4. Land and income inequality interact, moderating their respective effects on overall forest condition change. The mechanisms that drive this interaction remain a puzzle, and further information from the community level (in the following chapter) presents further investigation of these.

The game theoretic model presented earlier in this chapter provides insights into how collective action can break down under conditions of inequality. These findings do suggest that, at the county level, inequality does have an effect on outcomes such as illegal logging and forestry incomes; but the overall role of inequality in driving forest **condition** outcomes is not simple, but interactive. It is impossible to say whether income inequality is the causal moderator of land inequality's effect on forest condition change, or if the reverse is true; indeed, compelling

arguments can be made in both directions. When communities do not have titles, economic equality may provide the basis for effective social sanctions and group cohesion to improve collective action outcomes. Conversely, when economic inequality is high, land titles may provide a mechanism for effective and sustainable community-based forest management and meaningful exclusion of other actors. The next chapter employs a community-level comparative case study to explore these potential mechanisms, and also to elucidate the role of intra-community inequalities and heterogeneities in driving forest governance outcomes.

The histories of both income and land inequality in Bolivia have been intertwined for the past half century. As land reforms began granting titles to communities – starting in 1996, and much more aggressively since 2006 – the impacts on forest governance have remained understudied. That decentralization has been occurring is in itself not very instructive with respect to understanding the suite of likely forest governance outcomes in the future. Moreover, a robust understanding of impacts of these reforms on forest-dependent communities, livelihoods, and the sustainable management of forests has itself remained elusive. This study has provided evidence for an important relationship between income inequality, land inequality, and land reforms in general, and forest governance outcomes at the county level. For the first time in Bolivia's history, communities now have some meaningful access to formal land titles in the lowlands. Mitigating the country's long-standing land inequality with these reforms does appear to have been somewhat effective in producing desirable outcomes. Given that in other parts of the world – such as in Indonesia – the effects of decentralization and *de jure* transfers of land to communities has been less well implemented with less desirable results, this is good news for Bolivian policy makers. At the same time, there are many persistent issues that Bolivian policy makers and people will have to confront in the future. Economic and land inequality still persists,



and the titling process remains less streamlined than many would prefer. Non-timber related pressures to deforest – particularly agriculture – will likely persist, and Bolivia will need to seek innovative approaches if it is to preserve its forests in the face of such macroeconomic motive forces. Conflicts between different actors will likely persist, and approaches to dealing with these conflicts peacefully and justly will continue to evolve over time. Nevertheless, this analysis of Bolivian municipal data provides insights into the roles of economic and land inequality in driving forest governance outcomes. Policy-makers from elsewhere can take useful lessons from this case, and further analysis of the specific factors that led the issuance of logging permits and land titles to meaningfully influence forest governance outcomes positively will allow decision makers to build and work with better institutions for forestry reform.

## **Chapter 4 - Community Level Inequality, Local Networks, and Forest Governance: A Comparative Case Study from the Bolivian Lowlands**

### **4.1 Introduction**

The previous chapter analyzed municipal data from Bolivia to assess inequality as a driver of forest governance outcomes. It was found that income and land inequality – just two of many other types of inequality – are variously associated with adverse outcomes with respect to illegal logging and forest incomes. The two types of inequality under study interacted to moderate each other's effect on overall forest condition change, but the mechanisms driving this moderation were not revealed by the analysis. The purpose of this chapter is to use data collected in 2012 from two Bolivian indigenous communities with formal land titles – Cururú and TIM (*Territorio Indígena Multiétnico*) Ivirgarzama – to conduct a comparative case study that shows the specific, local-level mechanisms through which inequality can influence forest governance outcomes.

Both communities have formal titles to their land, but differ along other dimensions of inequality. Income inequality, wealth and asset inequality, and – crucially – institutional and network-based inequality, which reflect power, differ in important ways between the two communities. These differences will be assessed, and conclusions drawn to bolster the theoretical understanding of how inequality and various types of heterogeneities drive forest governance outcomes at the local level.

This chapter makes two principal arguments. First, economic inequality as measured by income and expenditures (the most common measures used by development organizations and scholars) is insufficient to capture inequality and heterogeneity as it relates to processes that drive forest governance outcomes. Income, assets, ethnicity, and kinship can all play a role in coupled human and natural forest systems. The degree to which any particular type of inequality or heterogeneity matters depends on the levels of other inequalities and heterogeneities, along with other community characteristics. In communities with more market connectivity, inequality in cash income may be more important, while ownership of particular assets may be less important. The converse may also be true.

Second, economic inequality, social heterogeneity, and ethnic heterogeneity can produce network-based inequality. Network-based inequality is used in these communities by elites to capture benefits from forest resources, and to simultaneously shift the costs of environmental degradation onto non-elite actors (Downey and Strife 2010). Both communities have network-based inequality, but to different degrees and with different conditioning factors. Network-based inequality is generally lower in Cururú, and forestry outcomes have generally been better compared to TIM Ivirgarzama. The factors that produce this network-based inequality are analyzed in this chapter, and further questions that inform the subsequent empirical chapter are

developed. Particular attention is paid to how institutions can promote *de facto* enforcement of *de jure* property rights, and how the adverse consequences of inequality can be mitigated. The analysis in this chapter demonstrates that the moderating effect of community land titling on income inequality with respect to forest degradation discussed in the previous chapter does not imply that land titling is a sufficient action to facilitate meaningful collective action and sustainable forest management.

This chapter is structured as follows. First, the relevant types of inequality are reviewed. Second, the two communities are introduced and characterized. Third, a qualitative comparison is made between the types of inequality and heterogeneity that are present in each community, and how they differ. Fourth, social-network analytic tools are used to show how network-based inequality differs between the two communities, and how it is an important driver of local outcomes. Finally, implications are drawn and further questions for study are raised. The role of institutions in effectively producing *de facto* enforcement of *de jure* property rights is examined, and specific questions are generated that are investigated in the subsequent chapter.

#### **4.2 Inequality and Heterogeneity at Multiple Levels**

Inequality and heterogeneity exists at multiple levels of social organization, and it exists in many varieties. It is of interest to many actors including public sector decision makers, private firms, NGOs, and citizens. Inequality is studied because it is itself important as an indicator of fairness and social justice, and because it is an instrumentally important driver of societal, institutional,

and socioeconomic processes. Inequality in Bolivia is quite high, with a Gini index<sup>15</sup> of 56.3, slightly greater than its infamously unequal neighbor Brazil's 56.1. The previous chapter of this dissertation provides a description of the history of inequality in Bolivia. Bolivian society has itself been concerned with inequality. At least one armed revolution (Victor Paz Estenssoro's revolution of 1952), and one sweeping political upheaval (Evo Morales's election in 2006) have been at least ostensibly a result of perceived inequality.

The geography of Bolivian inequality is complex and arguably fractal in nature. Economic inequality exists between departments, between provinces within departments, between counties within provinces, between communities within counties, and within communities themselves. Economic inequality is often measured monetarily, as income and wealth. However, assets are also sometimes taken into account in scholarly studies of inequality. Social, cultural, and ethnic heterogeneity is another important variable in Bolivia. Some communities have only one ethnicity represented, while others are comprised of many ethnicities.

While inequality and other heterogeneities can be measured a number of ways – through economic, sociocultural, and land-based measures, for example – scholars of environmental sociology inequality is necessarily linked through power to environmental degradation (Boyce 2002). Downey and Strife (2010) argue that inequality creates conditions in which elites can monopolize decision making authority, offload the costs of environmental degradation onto non-elites, and simultaneously benefit disproportionately from the exploitation of natural resources.

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<sup>15</sup>The Gini index is a measure of inequality, commonly applied for income and wealth. It is based on the Lorenz curve, a monotonic function that plots the percentage of individuals (or households, or other relevant unit of analysis) against the percentage of income or wealth (or other indicator of interest) that they control. In a group that had a perfectly equal distribution of wealth – wherein each individual had the same amount of wealth – the slope of the Lorenz curve would be equal to unity; each 1% of the population controls an additional 1% of the wealth.

They refer to network-based inequality as having unequal access to social capital, which can affect the flow of other benefits, rights, and obligations. While most of these arguments have been made using evidence from networks that are regional and larger, the rest of this chapter analyzes these processes at the local level in the Bolivian communities of Cururú and TIM Ivirgarzama.

### **4.3 Networks and Network-based Inequality**

The empirical analysis from two lowland Bolivian communities suggests that at the local level, networks of actors are formed and sustained, and that inequality is embedded in these networks in such a way as to compromise collective action. Network-based inequality is not well reflected in other measures of inequality and heterogeneity. Neither economic prosperity nor belonging to a particular ethno-linguistic group necessarily confer the benefits associated with being in a key network. Networks coalesce around a variety of actor characteristics, including economic status and group membership, but also due to political expediency and shared ideas (McDonald 2011; Lin 2000 “Inequality in Social Capital”). The formation of these networks therefore depends on the history, and the specific context of time and place.

Studies of networks and their role at the local level are very limited. However, their importance at higher levels of governance (Domhoff 1993; Busch et.al 1997), it is possible that networks are also important at smaller scales. To what extent does belonging to networks confer additional privileges to individuals, beyond what is conferred by other measurable characteristics like wealth, income, caste, gender, and ethnicity? The results of this comparative analysis from two Bolivian communities suggest that the answer is a great deal.

#### 4.4 Data Collection and Methods

Data was collected between June and July of 2012 in Cururú and TIM Ivirgarzama as part of a larger international project with components in both Bolivia and Uganda funded by the National Science Foundation's Coupled Natural and Human Systems program (CNH). Multidisciplinary research teams, coordinated by the Bolivian NGO Center for Studies in Economic and Social Realities (Spanish: *Centro de Estudios de la Realidad Economica y Social*, or CERES) were dispatched to these sites to collect data utilizing the IFRI (International Forestry Resources and Institutions) methodology. Data collection was supported in part by the National Science Foundation<sup>16</sup> and the Center to Advance Research and Teaching in the Social Sciences (CARTSS). This standardized approach involves biophysical measurements of forest conditions through a robust sampling methodology, along with ten distinct forms to capture key institutional and socioeconomic characteristics of these coupled natural and human systems (or social-ecological systems). Household surveys were also conducted. Given the small number of households in each community, it was not necessary to sample households. Instead, all households that were available were surveyed, and most households in both communities were reached (two households could not be reached in Cururú, and four households could not be reached in TIM Ivirgarzama). In total, 45 households were surveyed – 20 in Cururú, and 25 in TIM Ivirgarzama. One challenge in the field was determining what constituted a household. The IFRI approach defines a household as a group of related individuals who share a living and cooking space. This definition still leaves some open questions, as newly married young people, for example, may spend time living and cooking in multiple physical homes. Other households,

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<sup>16</sup> Grant # DEB-1114984

particularly young ones, might in principle have their own physical living structure, but in practice eat and sleep with extended family elsewhere.

The IFRI methodology is designed to be flexible, and permit many different types of local contexts to be studied. CERES Bolivia has a long history of collaboration with the IFRI network, and has developed a number of important in-house strategies for collecting relevant data. These include:

- (1) Constructing an agricultural calendar with community members to understand what crops are important, in addition to how, when, and where they are grown
- (2) A participatory mapping exercise to ensure that the community limits, and the forest limits are clearly understood
- (3) A community meeting wherein local peoples' opinions are solicited on the most pressing challenges that they face with respect to forest governance and other topics
- (4) Community-led institutional mapping, wherein key organizations and actors are diagrammed in relation to each other.

Throughout this process, key informants from the community are consulted to provide qualitative background information and context, and also to discover key facts about the community, the forest, and the local people.

The household surveys were designed to ascertain a wide variety of demographic, socioeconomic, and institutional information at the household level. These surveys were explicitly constructed to supplement the broader IFRI methodology, which emphasizes the importance of forest user-groups. Forest user-groups are defined as groups of individuals who use the same forest resource, and have shared rights and responsibilities over these resources.

Household surveys were thus instrumental in determining exactly who uses what resources. In the field, these conversations with household heads were used to determine the types of networks that different actors were embedded in. This was possible by cataloguing familial relationships between households, and triangulating these relationships with user-group membership and also expressed opinions about extractive practices.

Both communities had been visited by CERES in 2007 for other projects, and qualitative community-level from those visits is used below, primarily to provide complete descriptions of the communities' sociocultural histories, socioeconomic characteristics, and institutional histories. Household survey data is available for these communities from 2007 as well, but the survey applied in 2012 was sufficiently different that longitudinal comparisons – particularly with respect to inequality and heterogeneity – were not possible.

The following sections describe the two communities.

## **4.4 Cururú**

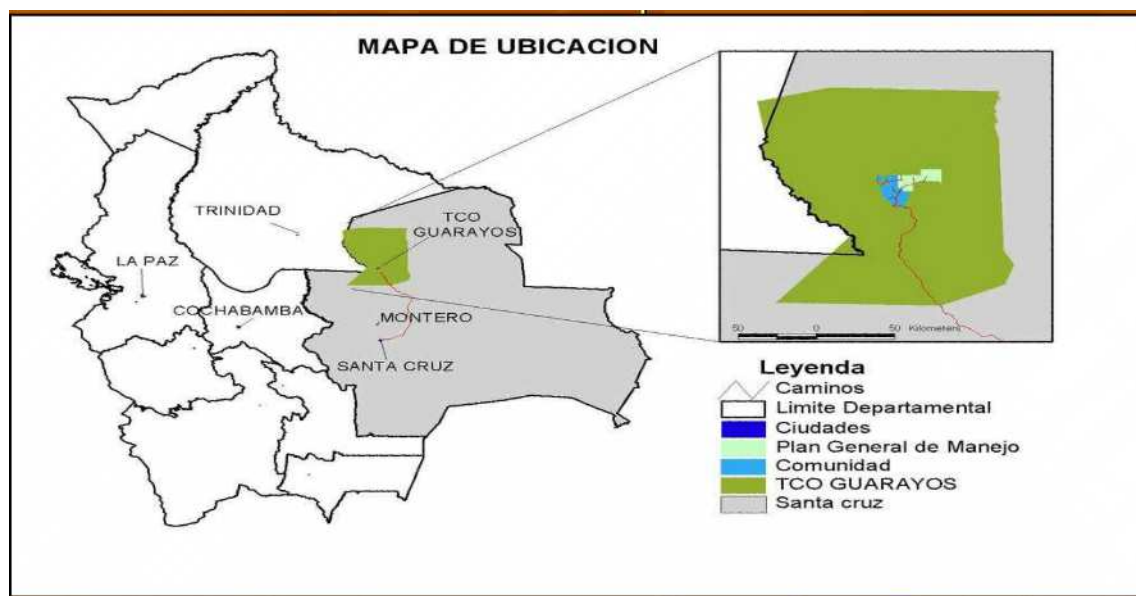
### **4.4.1 Biophysical site information**

Cururú is situated in the department of Santa Cruz, close to the border of the Beni department (GPS coordinates -15.818889, -63.333333). These are the two largest departments of Bolivia, and they are home to large tracts of tropical forest. Data was collected in Cururú in July 2012 using an abridged version of the IFRI (International Forestry Resources and Institutions) framework, along with a household survey that was applied to all available households in the community. In addition, data was collected using the full IFRI protocol in 2007 as well as another household survey. The landscape is topographically flat, extensive, and traversed by many meandering rivers and streams that all ultimately flow to the Amazon. The forested



landscape is wet and humid, averaging over 80 in. (2032 mm) of precipitation annually. Most of the rain falls between October and April, with little comparatively little precipitation between May and September. The forests of the region are home to dozens, if not hundreds, of common tree species. Many of them, like mahogany and the sandbox tree (*Hura crepitans*), command a high price on global timber markets. Others have important local uses for medicine, food, hygiene, and even potable water during expeditions into the jungle. Wild chocolate plants grow in the region, although it is not widely harvested for sale or export as of July 2012. Figure 4.1 shows the location of the community within Bolivia and the province of Guarayos.

**Figure 4.1 Location of Cururú**



Source: CERES 2007

#### 4.4.2 Community history

The Guarayo people arrived in the modern day province of Guarayos in the 16<sup>th</sup> century (Nordenskiöld 1917), as part of the larger Guarani invasion of the Inca empire. The Guarayo

language is still mutually intelligible with the much more widely spoken Guaraní dialects, which enjoy prominence and official status in both Bolivia and Paraguay, and comprise the 4<sup>th</sup> most widely spoken language nationally in Bolivia. In the 18<sup>th</sup> century, Jesuit missions were established, and the Guaraní people entered into a highly dependent relationship with them. The missions were the most important centers of economic and cultural activity in the region. The Jesuits were expelled in 1767 by order of the Spanish crown, but other orders continued to actively run the missions. In particular, the Franciscan missionaries maintained a long-term presence in the region.

During the time of the Franciscan mission, the land that the community of Cururú currently occupies was a penal colony for the mission based out of the nearby Yaguarú mission. Community members who broke local laws were brought to Cururú for forced labor including sugar harvesting and processing and producing alcohol. As the leaders of the mission left during the missions' decline and departure in the 1920s, members of the Yaguarú community continued to cultivate the land in Cururú, and to pass that land on to their descendants. However, the community did not become a fixed population center until decades later.

In the 1970s, the heads of two families from Yaguarú – Yaboo and Macue – began to spend more time cultivating their inherited lands in Cururú. The Yaboo and Macue families both had family lands in Cururú, and were regularly traveling between Yaguarú and Cururú to cultivate their land. As the population began to grow in Yaguarú, and the amount of land per person diminished, there was ever more impetus to colonize more land in Cururú and settle their permanently. Yaboo and cue rallied 14 male household heads to found a permanent community in Cururú, and to establish cultivable lands for each family there. The most immediate problem that they faced was the lack of a school in the community. If they were to settle in Cururú

permanently, their children would have to make the arduous journey between Yaguarú and Cururú every day if they were to be educated. Macue explained that “Our children had to travel to Yaguarú to study, and this was very painful for us because we were never sure if they were eating or keeping well. So we decided to build a school inside the new community.” To deal with this, the new community members of Cururú built a school in the village in 1993. After the school was constructed, they contracted a priest to anoint their new community, inaugurating it as “Santa Teresita de Cururú.”

In 1995, the community was locally recognized by prefectural and municipal resolution in Urubichá. They were given legal status as an autonomous community with nationally recognized boundaries in 2002, covering a total of 26420.84 hectares. Cururú is one of many communities that are located within the Guarayos TCO. As far as the national government is concerned, the TCO is responsible for much of its own governance, including forest management. Because the TCO is large, and consists of many historically separate settlements and groups, communities like Cururú have been given land and autonomy within the TCO.

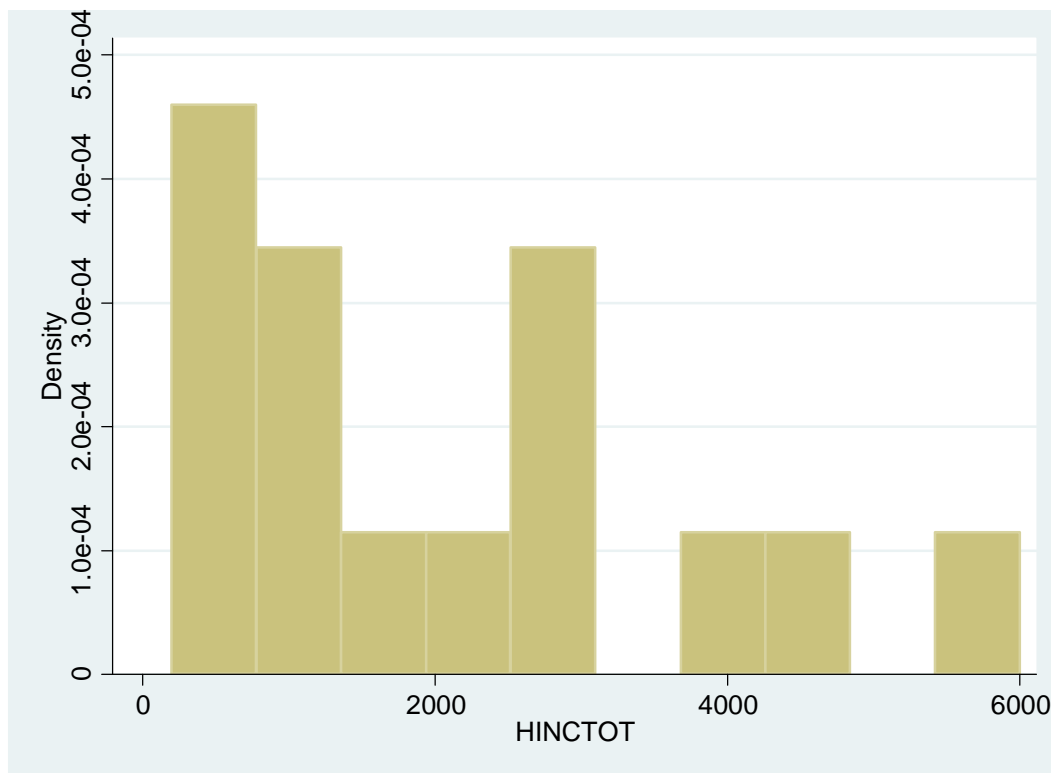
#### **4.4.3 Socioeconomic description of Cururú**

The community itself consists of 24 households (defined as groups of related individuals who share cooking and living space), although there are closer to 50 married couples, almost all of whom have children of their own. Including children, the population is approximately 170 (estimated by multiplying the average size of surveyed households by the number of households) although an exact number could not be ascertained given the high birth rate and large number of infants – the community does not maintain a current roster of all community members including babies, and two households could not be contacted. The community is located in the county of

Urubichá, approximately 20km from the small town Urubichá (population 4,500) and slightly closer to the town of Yaguarú (population 1,500). The inhabitants of the community are all ethnically Guarayos, and all speak the Guarayos language. Nearly all members of the community also speak Spanish well, with the exception of some elderly members and the very young.

Cururú is very much within the economic sphere of influence of the larger settlements of Urubichá, Yaguarú, and the provincial capital of Ascención de Guarayos. Many members of the community, particularly the men, travel to these towns for day-wage work. Food crops and animal products from the community are frequently sold in these markets. The median monthly income in the community is 1900 Bs. (271 USD), but with a very high standard deviation of 1694 Bs (241 USD). In other words, the apparent inequality within the community is very high in terms of cash income. This inequality is called “apparent” because goods and even cash are often shared between so-called “households,” many of which are closely related (the male heads of two nominally distinct households may be first cousins or even brothers, for example). The median household size is seven, meaning that there is an average of \$38 per month per person, or \$1.2 per day. Given the large disparity in cash income among households, there are many individuals who have virtually no cash income at all. Wage labor is by far the largest source of household income within the community. All households earn at least some of their income from wages, and the majority (75%) households explicitly characterized wage income as a very important source of household income. Figure 4.2 shows the distribution of monthly income among households of the community.

**Figure 4.2 Histogram of total household income**



There are only a few households that have relatively high household incomes, and even those do not add up to more than a few dollars per person per day, given the average size of the households. The community can therefore be characterized as generally impoverished.

However, the low cash incomes do not tell a complete story. While cash incomes are low, and community members have very low savings, they do have other assets. First, since the legal consolidation of the community in 2002, all community members are legally entitled to the use and management of 50 hectares of land. In reality, no households actually use and cultivate anywhere close to this amount of land. On average, community members actively cultivate an average of just 3.9 hectares, with a range between 0.5 and 10 hectares. The implication is that subsistence agriculture is critical for the community members' livelihoods, with 78% of responding households producing at least 90% of their food by themselves through agriculture, hunting, and fishing. All households participate in subsistence agriculture, with widespread

cultivation of yucca, maize, bananas, rice and potatoes. In general, households that have higher incomes tend to produce somewhat less of their own food. The few households with particularly high incomes also produce a particular small proportion of their own food ( $p=0.02$ ,  $r = -0.61$ ).

Apart from income, there is also considerable inequality with respect to animal ownership. Pigs and chickens are the most common animals owned by community members. There are also several ducks, and a large number of dogs who are communally “owned.”

With respect to wage labor, the Indigenous Management Plan for timber is extremely important. In addition, profits from the sale of timber are distributed as a bonus to all community households. These bonuses are quite small compared to the wages that households earn from participation in the community timber enterprise. The Indigenous Management Plan and the community’s utilization of timber and other forest resources in general is discussed in more detail below, as it is central to this study.

In addition to the subsistence livelihoods that complement cash income, the community members have a number of assets. The community members live in small houses made from wood with thatched roofs. All individuals in the community have access and use rights to a house, irrespective of age and sex. Most married adults have ownership over their houses, in that they hold property rights up to and including exclusive rights. Motorcycles were also universally accessible, though not all households directly owned them. Given that many separate households have close relationships, community members that didn’t personally own motorcycles can quite easily share or borrow one from a relative. Having access to transportation is essential for many households. With a motorcycle, they can travel to Urubichá or Yaguarú for day wage labor, transport goods to sell, and make purchases in local markets. On the flip side, liquid fuel for

motorcycles is a non-trivial expense for community members. Of the 13 households that reported regular expenditures on fuel, the average monthly expenditure was 124 Bs. (\$19.53).

Given the aforementioned income, expenditure, and holdings of community members, Cururú can be broadly characterized as a poor subsistence-based forest community. Poverty, as measured by income, is mitigated by a relatively low need for cash income and substantial assets in land and other possessions. However, the community is also vulnerable to natural risks such as flooding and drought. Of the 20 households that were interviewed, 11 cited memorable losses of income and assets to drought, and five to flooding. Illnesses in the family also present a serious threat to community members' livelihoods, with nine households citing significant losses of assets or income due to illness. In general, community members lack effective insurances against the losses that these risks can generate. In most cases, households can do nothing to recover their losses from natural hazards apart from spending very limited savings if they have them at all, or borrowing money at interest rates that often exceed 50%, according to a local economist.

## **4.5 TIM Ivirgarzama**

### **4.5.1 Biophysical site information**

The *Comunidad Indígena Yuracaré del Río Ivirgarzama* (or TIM Ivirgarzama) is a small forest community in the Cochabamba department, located relatively near the high-traffic paved highway connecting the cities of Cochabamba and Santa Cruz de la Sierra (GPS coordinates - 16.904444,-64.860833). The community has a settlement approximately 25 kilometers north of the highway, alongside the Ivirgarzama River. The climate is similar to much of the Bolivian lowlands, with precipitation averaging between 2200 and 2500 mm. per year, an elevation of 250 m., and temperatures that most commonly fall between 19-23 degrees Celsius. At the landscape

level, there are two primary biomes that coexist: floodplain forests, and savannah shrub and woodland. The floodplain forests are widespread, and can become inundated with water for months at a time. The community members live in this part of the forest for much of the year, but often times move to the nearby town of Ivirgarzama when the forest is flooded and impregnable. These forests are home to over 80 species of tree, of which between 15 and 20 have significant commercial value. These valuable species include timber species like cedar (which has virtually disappeared in the last 10 years) and laurels, along with many non-timber species such as oil-producing palms and fig species (CERES 2007). In 2007, between 23 and 25% of the trees in the forest were characterized by researchers as valuable or extremely valuable, with the remaining species of low or no economic value. The savannah shrub and woodlands exist between nearby rivers, where soils are drained too poorly to support tree life. These areas can also flood, but these lands are used less by local people for economic activity because they are not agriculturally productive, and do not produce many important species with the notable exception of fish.

The distribution of valuable trees has been changing, with marked degradation in many tree species. Commercially valuable species are especially rare, and other non-valuable species have also been degraded (CERES 2006).

#### **4.5.2 Community History**

TIM Ivirgarzama is a largely (but not exclusively) ethnic Yuracaré community with a TCO title in the Cochabamba lowlands, east of the Chapare river basin. The Yuracaré people are indigenous to this region, and have occupied various parts of it over time. TIM Ivirgarzama is in essence an offshoot community of the larger Yuracaré group that lives in the Yuracaré TCO in and around the town of Chimoré.



As peasants who lived under an essentially feudalistic system prior to the 1952 revolution slowly began to farm their own lands, they also began to spread out, and migration within the lowlands of the Cochabamba department accelerated. The search for land that could be farmed reliably was the primary impetus for these migratory movements. The Antezana family moved to the area around the banks of the Ivirgarzama river to set up farms in the 1970s as a part of this slow intra-lowlands migratory movement other parts of the lowlands.

The Yuracaré people that inhabited the area surrounding the Ivirgarzama river (essentially, the Antezana family and several other families; hereafter the Ivirgarzama-Yuracaré, to distinguish them from other Yuracaré groups) – with more permanent and urban settlements in the emergent town of Ivirgarzama – began to see important changes in the 1980s, as a wave of migrants from the highlands to the lowlands began to accelerate. This wave was largely in response to the structural adjustment policies of Victor Paz Estenssoro's second government, which led to the removal of thousands of miners and other state workers from payrolls. These former workers, who were primarily ethnically Quechua and Aymara people from the highlands, began to seek land for subsistence agriculture and small business in the lowlands, including the areas inhabited by the Yuracaré people. Because this region is quite close to the city of Cochabamba, and moreover almost directly along the road to the city of Santa Cruz, it has been particularly attractive for migrants from the Bolivian highlands. As a result, land tenure regimes have been less clear, and even today continue to evolve as different groups stake claims, and see conflicting claims negotiated or arbitrated.

The Ivirgarzama-Yuracaré began to stake out claims to lands around the Ivirgarzama river. The Antezana family, who had lived in the region prior to the wave of immigration from the highlands, were among those who began to more aggressively convert and colonize the forested



Because the Ivirgarzama-Yuracaré people are few in number, securing this territory involved coordination with several other geographically dispersed Yuracaré communities. A total of six communities jointly petitioned for land titles. They were eventually granted the title with the collective designation “*Territorio Indígena Multiétnico del Trópico de Cochabamba*” (TIM – TC).<sup>17</sup> Each of these communities is represented by the same coordinating office in the city of Cochabamba. The joint territories hold the *de jure* rights and obligations of the TCOs; but in practice, each community is fully autonomous.

This process was not immediate, and several conflicts occurred prior to securing this title. Other groups of colonists were using land that the Ivirgarzama-Yuracaré considered to be theirs. A series of conflicts with neighboring communities, and later, groups of settlers that were staking their own claims in the same territory, were ultimately negotiated or adjudicated by INRA. The result was the Ivirgarzama-Yuracaré being awarded a legal TCO titles to the land shown in red above in Figure XYZ. Although the community maintains a *de jure* title to this land, there are still *de facto* threats to their tenure security. In particular, one group of settlers – the Lagunillas community - has converted significant parts of the northern tract of the Ivirgarzama-Yuracaré peoples’ land for coca production, and these settlers have reliable *de facto* control of the land. The implications of these threats to tenure security and management rights are discussed in later chapters (CERES 2007).

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<sup>17</sup> Each community is technically referred to as a “Consejo Indígena Yuracaré” (Indigenous Yuracaré Council). They are the Consejo Indígena Río Sajta (CIRIS), the Consejo Indígena Yuracaré Río Ivirgarzama (CIYRI, or TIM Ivirgarzama), the Consejo Indígena Yuracaré San Salvador (CIYSS), the Comunidad Indígena Trinitario San Marcos (CITSM), the Consejo Indígena Originario El Progreso (CIOP), and the Consejo Indígena Yuracaré Uriyuta (CIYU) (Querejazu 2005).

### 4.5.3 Socioeconomic description of TIM Ivirgarzama

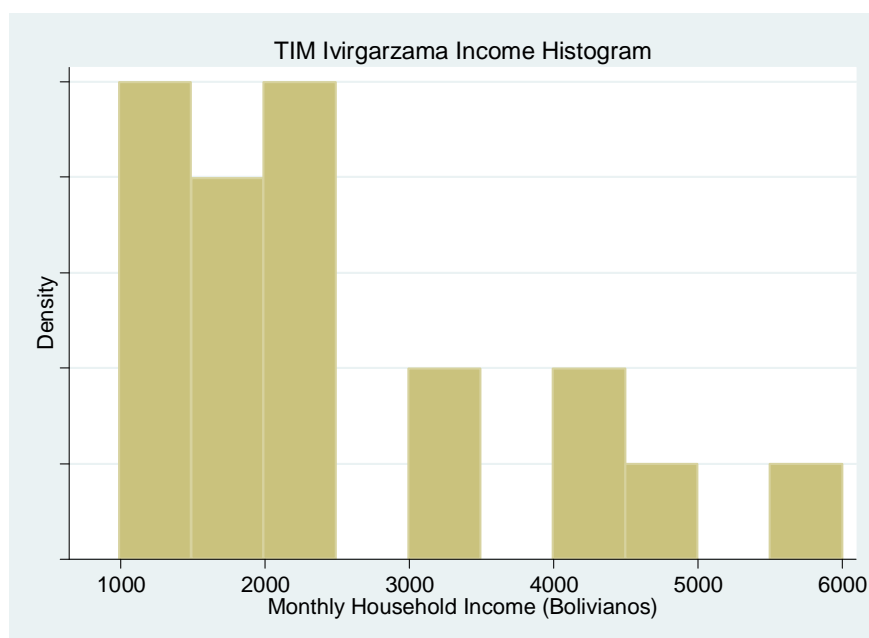
TIM Ivirgarzama, while ostensibly a Yuracaré community, is actually multiethnic. In 2007, 20% of the households had one non-Yuracaré member. In 2012, it had increased to roughly 30% (8 of 26 households surveyed). Virtually none of the community members speak the Yuracaré language, and Spanish is the clear lingua franca for community members of all ages. The rise in the number of non-Yuracaré households is related to ongoing immigration from the highlands. Ethnically Quechua and Aymara speakers continue to move to the lowlands, and sometimes marry into the TIM Ivirgarzama community. This interchange between community members and non-community members is especially facilitated by the particular livelihood strategy that the community members take.

Effectively, they have two livelihoods that co-exist, and even two settlements that they alternately inhabit. Community members spend some of their time in the TIM territory itself, where they fish, hunt, and cultivate crops such as rice, yucca, corn, bananas, coca, and chocolate; they also spend a considerable amount of time living in the town of Ivirgarzama, where most community members have a secondary home. Community members work as wage laborers when they are in the town of Ivirgarzama, and many travel back and forth between the two settlements with regularity, depending on the season, the labor needs in the field, and the availability of work in town or elsewhere.

Ivirgarzama itself has a population of approximately 6,300 as of the 2001 census and according to local people it has continued to grow since then. Because the major highway connecting the cities of Santa Cruz de la Sierra and Cochabamba passes through Ivirgarzama, it is highly

connected to Bolivian national markets, and is sensitive to economic conditions in the country as a whole. Thus, community members do participate in cash economies, especially given that much of their time is spent in the urban settlement. The distribution of cash incomes is highly variable on a monthly basis (Figure 4.4 presents a histogram of household incomes). The median income for the community is 2000 Bs. (337 USD) with a standard deviation of 1424 Bs. (203 USD). With an average household size of just under five people, this is approximately \$2.50 per day. Households spend an average of 976 Bs. (139 USD) per month on food, and 300 Bs. (42 USD) on fuel, for both transportation and cooking.

**Figure 4.4 Income Distribution in TIM Ivirgarzama**



This distribution reflects that fact that some households have very high incomes, while others have very small incomes. Moreover, cash incomes are highly volatile, and exhibit seasonal and inter-annual variation. Cash income is more important when households are not producing their own food, and cash income is more available when market conditions are favorable in

Ivirgarzama and in Bolivia in general. In general, cash income is very important for households to meet their basic needs, and most households reported that wage labor was their most important economic activity. On average, households produce 18.4% of their own food, with a very high standard deviation of 22.4%. Moreover, higher earning households tend to produce more of their own food than poorer households ( $r = 0.58$ ,  $p < 0.01$ ), suggesting that poorer households may be stretched doubly thin with respect to the provision of their basic needs). Monthly food expenditures in

Households in TIM Ivirgarzama are susceptible to a number of risks and economic shocks. The lowland forests of Cochabamba are prone to flooding, and do so with some regularity. Although seasonal flooding is a natural characteristic of the local ecosystem, it has consequences for people. In wet years, where flooding is severe – including 2012, when this data was collected, on the heels of an even more devastating flood season in 2011– crop loss can be high, and yields can be difficult to recover as the community’s arable lands become inaccessible. Structural damage to houses and roads along the river is common in the region as well (Figure 4.5 below shows damage from flooding in 2011 in the nearby Chapare river basin). In severe flooding events, road damage can cut off access to markets, and interrupt economic activities for long periods of time.

**Figure 4.5 Flood Damage in 2011 in Chapare**



Most households (22 out of 26) reported that flooding was the most severe risk that they faced. The second most important threat to peoples' well-being is illness. Eight households reported a severe illness within the past year that caused economic losses, and access to medical treatment is limited for most community members in most cases.

TIM Ivirgarzama can overall be characterized as a poor community with two key settlements, one rural and embedded in a forest, and another urban. The people produce some food, but largely depend on wage labor for their livelihoods. Non-timber forest products such as fish and game are also important supplements for households. Timber extraction represents a small part of the economy, but not all households benefit from it. This is described in the following section, which compares TIM Ivirgarzama to Cururú with respect to forest resource management and its relationship to inequality.

#### **4.6 Local Forest Management in Cururú**

Cururú has a consolidated indigenous management plan for sustainable timber extraction. The community is situated within the Guarayos TCO, and its management practices are situated

within the context of the TCO's rights and obligations. The indigenous management plan is governed by the community's autochthonous institution, AIMCU (*Asociación Indígena Maderera Cururú*, or Indigenous Timber Association of Cururú). It was approved by the national forest superintendent (SIF) in 2001, but in practice was already extracting timber prior to that. The Guarayos TCO itself coordinates the activities of its constituent communities, including Cururú, through its *Central de Organizaciones de los Pueblos Nativos Guarayos* (COPNAG, or the Center for Guarayo Native Peoples' Organizations). SIF and COPNAG both emphasize sustainable forest management in their official rhetoric and in principal only approve and coordinate extraction that is considered to be sustainable according to a number of criteria. COPNAG, and the TCO Guarayos, was indeed formed largely in response to the perception that outside interests were unsustainably exploiting provincial resources in the 1980s and 1990s (Vallejos 1998).<sup>18</sup>

AIMCU was founded as a community organization of forest governance in 2001. Prior to receiving explicit approval by SIF (all indigenous timber management plans require such approval), AIMCU extracted timber in coordination with the neighboring Salvatierras community. During this time, the NGO BOLFOR<sup>19</sup> began coordinating with a number of community members to develop a new sustainable forest management plan. BOLFOR ceased its operations in 2008, in part due to increasing momentum within the Morales administration to

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<sup>18</sup> Chapter 5, which focuses on institutional design in these communities, describes these organizations in more detail.

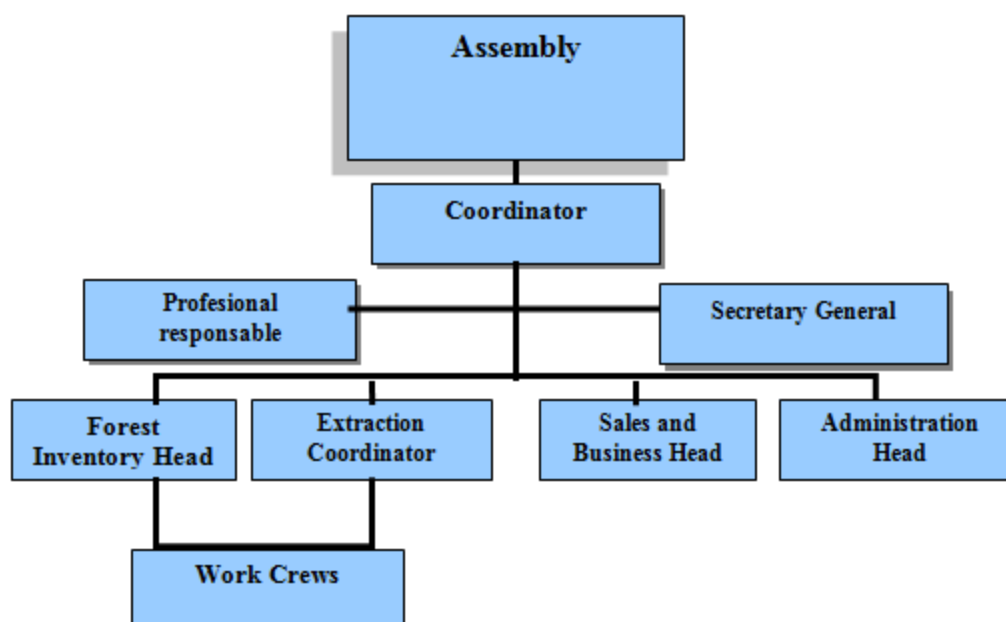
<sup>19</sup> BOLFOR was supported by USAID money, through the private firm Chemonics, which implements much of USAID's international agenda. Chemonics is a for-profit firm that has received more than \$700 million in contracts in recent years; USAID does not track or monitor the activities of Chemonics sub-grants, stating that it lacks the resources on its website (USAID 2012).



stop the influx of USAID dollars. After obtaining approval from the superintendent, the community continued to harvest timber according to its plan.

When AIMCU initially obtained approval for its plan, a hierarchical governance structure was proposed (Figure 4.6).

**Figure 4.6 – AIMCU Hierarchical Structure**



In practice, most of these positions were never filled, and only three individuals have *de facto* decision-making authority and power in the organization. These three individuals – Raul, Ramón, and Juan<sup>20</sup> - are ostensibly the coordinator, the extraction administration head, and the forest inventory/extraction coordinators. In practice, they jointly control all sales negotiations, administrative decision making, forest inventory and monitoring, and work crew supervision.

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<sup>20</sup> These are not the real names of these individuals. These and other names have been changed to protect the privacy of the individuals, in accordance with the IRB Protocol #12-0230.

According to Raul, when AIMCU was approved in 2001, it was agreed that after operating costs were covered, 3.5% of forestry revenues would go to COPNAG, another 5% to the Cururú community administration, and 15% to social projects including improvements to the school, infrastructure for water, and other infrastructure. Community members report that in practice, projects have not been funded by revenues from AIMCU, but profits are shared among households. Typically, profits are very small, and households receive on average 500 Bs. (71 USD) per year. The benefits from forestry to the community are, therefore, largely in the form of wage labor. All households participate to varying degrees in timber extraction, and are paid for their time on the work crews. Teams of approximately 15-25 men and 2-4 women (who work as support staff and field cooks) set out for 20-30 day excursions to selectively extract valuable timber species approximately three times per year. Many community members expressed dissatisfaction at the amount of work that was available, and also at the lack of investment in community projects. On the other hand, community members were generally grateful for the opportunity to earn wage labor in the community itself, because it doesn't require travel to far away towns and cities.

Overall, Cururú has a functional community-based forest management regime wherein all community households derive some benefits from the natural resource, primarily through wage labor. In spite of these benefits, a few individuals have captured most of the decision-making authority, and also capture some benefits from forestry. Moreover, they use their power to determine how other benefits from forestry – particularly, jobs – are distributed among other households.

#### **4.7 Local Forest Management in TIM Ivirgarzama**

When TIM Ivirgarzama was established as part of the more diffuse TIM – TC TCO, forest management rights were also conferred to the community. An indigenous management plan for timber was drafted and approved, for the northern portion of the community territory, but no coordinated extraction has actually occurred to date. This is due in part to ongoing conflict with another community in this area, who has staked out agricultural plots primarily for coca production. Other factors may also be at play – a relatively small number of community members control the community government, and some community members suggested that this elite group has struck a deal with the other community wherein they receive monetary or other benefits in exchange for not pursuing further adjudication of the conflict.

Nevertheless, timber extraction does occur in TIM Ivirgarzama. Out of 26 households, 9 are actively engaged in timber extraction, but not according to an approved plan. These activities therefore constitute illegal logging. Apart from the community government itself, there are no other organizations with *de facto* authority or oversight over these activities, and they proceed with the participation of these groups. The majority of the community members, who are not involved in timber extraction, consider it to be a significant problem and a source of conflict within the village. According to local woman who has been in the community since before it started, “[The extended family principally engaged in illegal logging] extracts timber wherever they want, without consulting the assembly. They do not share their incomes with the community, even though we agreed early on that 10% of any profits from timber extraction should be returned to the community for reinvestment. There’s hardly any valuable timber left, and many of the forest animals and plants have been depleted.” This sentiment was widely shared; in addition to the perceived unjust distribution of forestry benefits, there was also widespread concern over forest degradation due to unchecked illegal logging.

The quantity of timber extracted by this group is not known, and no records are available. Interestingly, there was tension in the community over this issue, but those who were actively engaged in illegal timber extraction were largely willing to discuss it. Overall, TIM Ivirgarzama does not have a functional or coherent community-based forest management regime. The benefits from its timber resources are almost entirely captured by an elite group, and forest degradation is perceived to be high.

#### **4.8 Comparative Analysis: Inequality, Heterogeneity, and Forest Governance**

As described previously, inequality and heterogeneity exist in many forms, and can play an important role in facilitating or compromising effective collective action in forest resource governance. In both communities, income inequality is fairly high. As Poteete and Ostrom (2004) find, different types of inequality and heterogeneity can have different effects on forest governance in different contexts. As was shown in the previous chapter of this dissertation, at the county level, Bolivian land inequality and income inequality may be associated with adverse forest governance outcomes – illegal logging and net benefits from forestry. Overall forest condition change is linked to both land and income inequality, in such a way that the two appear to moderate each other's effect. Looking at Cururú and TIM Ivirgarzama is instructive in understanding the mechanism through which these types of inequality, and also other forms of heterogeneity, might drive forest governance outcomes.

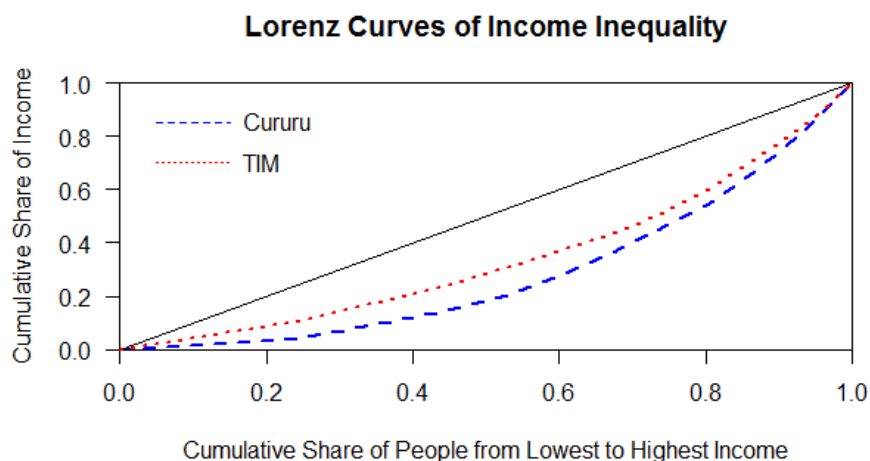
##### **4.8.1 Economic Inequality**

One limitation of the data that is often derived from national censuses and also community-level surveys is that monetary economies are assumed. Inequality measures, such as the one imputed by World Bank researchers to assess county-level inequality (Arias and Robles 2007), are often

focused exclusively on income and expenditure. At larger spatial scales, these are extremely useful measures of poverty and even well-being. Many scholars have attempted to develop new proxies for well-being that transcend the focus on income of the GDP, and such indices as the Human Development Index (HDI) and the Genuine Progress Index (GPI) are the results of these endeavors. In spite of these efforts, at the scales at which these indices are applied, they have been found to add complexity, but not much descriptive power, to GDP (Delhey and Kroll 2012). While the argument that additional indices of well-being do not add much beyond what GDP reveals is statistically robust, the conclusion is not that other measures of well-being don't matter. Rather, the implication is that it is difficult to condense the information contained by these multiple measures into a single useful index. In addition, different measures are more important in different contexts.

Cururú and TIM Ivirgarzama present an excellent example of different measures of well-being (and consequently, inequality) being disparately important in different contexts. For cash income, for example, the Gini index for Cururú is 0.42, compared to .31 in TIM Ivirgarzama, although bootstrapped standard errors reveal that this difference is not statistically significant ( $p > 0.1$ ). Since virtually all households were surveyed, rather than a particular sample being taken, it is debatable whether or not it is meaningful to estimate standard errors for comparison between these sites (Gamboa et al. 2012). Figure 4.7 shows a Lorenz curve for both communities' income distributions.

**Figure 4.7 – Income Inequality in Cururú and TIM Ivirgarzama**

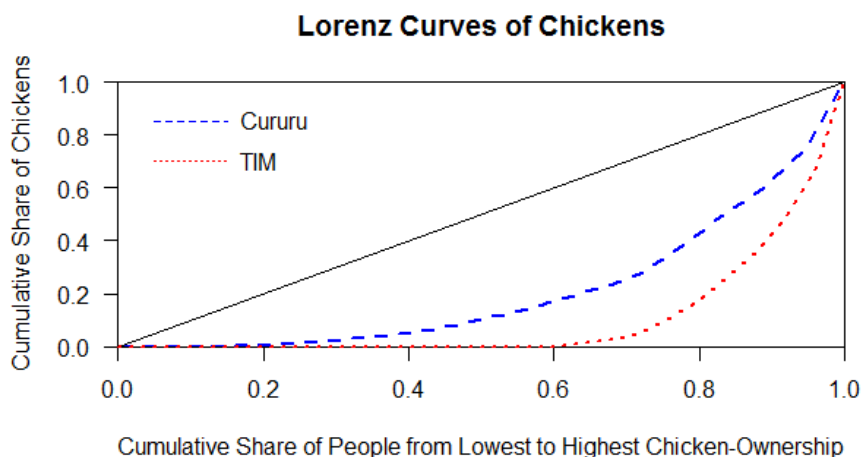


Given that a near-census was taken in both communities, it is conceivable that the difference in inequality between the two communities is indeed real, rather than a statistical artifact.

Regardless, it is a fairly small difference – both communities have very similar average income levels, and the distribution of cash income within each community is comparable.

Other measures of economic inequality present a different picture, however. A cursory visit to either community will reveal that households vary in the number of animals they possess. In both communities, chickens and pigs were two most important animals that households owned. Some families owned ducks as well. These animals are important for both subsistence and cash income, depending on a household's particular circumstances. To visualize the distribution of chickens – by far the most numerous and commonly held animal in both villages – a Lorenz curve was constructed to reflect chicken possession (Figure 4.8).

**Figure 4.8 The Lorenz Curves for Chicken Ownership in Cururú and TIM Ivirgarzama**



The Gini index for Cururú is 0.54 (SE = .06), compared to 0.77 (SE = .05) for TIM Ivirgarzama. This difference is marginally significant ( $p < 0.1$ ), although such statistics should once again be interpreted only as a heuristic given that the data were more akin to censuses than a samples. This figure presents a very different picture of economic inequality between the two communities. It is worth noting that both communities are rather unequal with respect to the distribution of this asset. In Cururú, the less unequal of the two, there are still a relatively small group of people that control a disproportionate share of chickens. TIM Ivirgarzama, however, is even more extreme – 15 households have no chickens at all, seven households own between two and 20 chickens, and one household owning over 50 chickens by itself. The implication is that income is an important but insufficient measure of intra-household inequality.

To what extent does economic inequality facilitate or compromise collective action in natural resource management? In TIM Ivirgarzama, one member of a poorer household stated that,

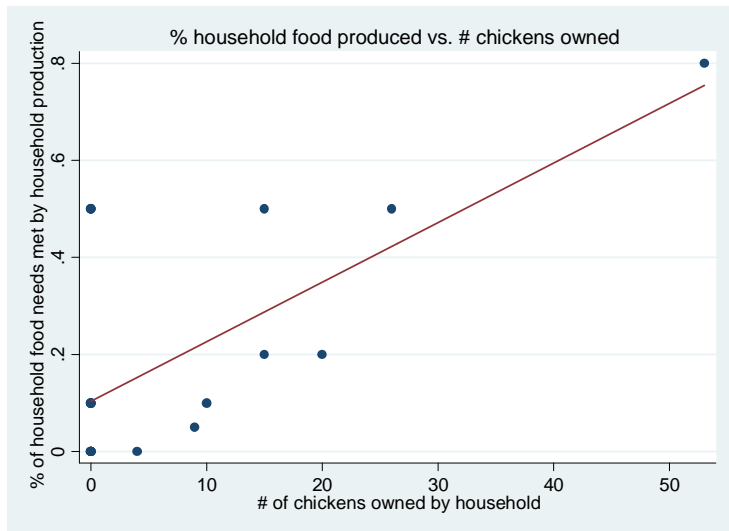
“There is hardly any valuable timber, and it’s exploited by the *madereros*.<sup>21</sup> My sons have gone to the city to find work, and they send money back – why would we extract timber when we need to look after our basic needs?” Conversely, a respondent from a household that does extract timber said that, “We extract timber because we’re able to, and it pays well. Other members of the community may want to extract timber too, but they don’t for their own reasons.” This disparity in perspective on timber extraction within the community was common, but it is not explained by economic inequality alone. That said, poor households that struggle especially to make ends meet are not in a position to spend time and build social capital necessary to participate in lucrative forestry activities. Furthermore, in TIM Ivirgarzama – where inequality with respect to chickens, an important asset, is high – households that are poorer in this metric tend to produce less of their own food, and therefore rely on cash income as a livelihood supplement to a greater degree. The results of a simple linear regression between chicken ownership and the percentage of food consumption that a household meets through its own production are shown in Figure 4.9 ( $p < 0.05$ ).

**Figure 4.9 Household Food Production vs. # Chickens Owned**

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<sup>21</sup> Individuals who harvest timber, although households are a more relevant unit of analysis for this case as the benefits from forestry accrue at the household level.





On the other hand, in Cururú, where inequality with respect to chicken ownership is lower, and households generally grow much more of their own food, no such relationship exists. The reduced need for cash in Cururú may thus moderate the effect of asset-based poverty and inequality on qualitative livelihood outcomes, and perhaps moreover collective action. In TIM Ivirgarzama, there are much clearer divisions within the community, and it is useful to examine the networks that have formed around these distinct groups.

#### 4.8.2 Network-based Inequality

In TIM Ivirgarzama, the households engaged in timber extraction constitute a user-group (locally referred to as *madereros*, which roughly translates to “timber extractors” in English), which is usefully defined by IFRI as a group of individuals who use the share the same recognized rights and obligations over a particular resource. The *madereros* of TIM Ivirgarzama are largely part of the Antezana family, with three exceptions. The Antezanas were the drivers of the formation of the community in the late 1990s. In order to consolidate the community members needed to be brought into the fold to strengthen the petition for land and title. Because the Ivirgarzama-

Yuracaré were a diaspora of a broader Yuracaré, they were rather integrated with non-Yuracaré populations prior to and during the titling process. In essence, the community was largely an *ad hoc* structure created to secure land tenure, and was not strongly based in a historical community with shared language, history, culture, land, or tradition.

As non-Yuracaré individuals began to marry into the community, the Antezana family and other households with longstanding relationships with them began to constitute a local elite. This elite group is characterized not only by exclusive *de facto* control over timber extraction, but also by key positions in the community government. The three non-Antezana households that are involved in timber extraction are involved by virtue of their key role in the community in recent history, or due to opportunities afforded to them through comparative wealth. The head of one such household played a key role in organizing and lobbying during the early days of the community. According to one of the other *madereros*, “[The head of the non-Antezana household] had lived and worked in the town of Ivirgarzama for many years, and knew people in CIDOB<sup>22</sup> and the local government. He led the process of petitioning for the community title.” In spite of not being a member of the family that would eventually become the core of the local timber elite, this individual established strong ties with them, and was able to position his household to participate in timber extraction. The second non-Antezana household that participates in timber extraction is characterized by an unusual degree of wealth for the community. This household owns a car, and uses it to run a small taxi enterprise. The level of

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<sup>22</sup> CIDOB – the *Confederación de Pueblos Indígenas de Bolivia* (English: Confederation of Indigenous Peoples of Bolivia) is an indigenous advocacy organization that has become a hub for organizing the agendas of indigenous peoples throughout the lowlands (including in Guarayos, where Cururú is located, and in the Cochabamba tropics, where TIM Ivirgarzama is located). Its network and resources, according to people from both communities, has been important in securing titles for indigenous communities.

wealth in the community is in general prohibitively low for this type of activity. Given that timber extraction is capital intensive, requiring chainsaws and other machinery, this particular household was able to support early timber operations, and has continued to participate since. The third household that participates in timber extraction despite not sharing kin ties to the Antezanas has been included because the household head worked for a timber company prior to the consolidation of TIM Ivirgarzama, and had key experience.

Notably, membership in the *maderero* group is not neatly explained by ethnicity, wealth, income, or language. Kinship played a role in the construction of the *maderero* group, but not exclusively. Ultimately, inclusion in the group is determined through a political process wherein individuals who are not related to the Antezana family can join the network if their inclusion is perceived by the other group members to be particularly expedient. Once a household is part of the network, they contribute to the process of timber extraction, and only in extreme circumstances will be removed from the network. In this way, the network is sustained as benefits continue to flow. The network is strengthened by this flow of benefits, which incentivizes the preservation of the network, and also by social capital that is developed through the process of working together (Horne 2007; Lorenzen 2007; Jiang et al. 2009).

The other households that are not part of the *maderero* user group perceive themselves as being deliberately excluded from extraction. Perhaps surprisingly, no punitive actions have been taken by this majority group through the community general assembly, even though the assembly is authorized to do so according to the community charter. According to one non-*maderero* respondent, “Everyone knows that they are extracting timber without permission, but the rules aren’t enforced at all. They are supposed to share 10% of their profits with the community, but we don’t hold them accountable in the assembly.” Part of the issue is that while the *madereros*

are largely unified<sup>23</sup> in their behaviors and attitudes towards forest resources, the non-*madereros* do not have any such group cohesion. This cohesion may be the result of social capital that has been developed from working together in the process of timber extraction itself, and as an artifact of the relatively reliable flow of benefits that the network has produced. Conflicts were reported among the non-*maderero* group, and they reflect a lack of enforced social norms and sanctions. One young non-*maderero* community member reported that when a motorcycle went missing, she was accused of stealing or selling it, and was nearly expelled from the community. However, she defended herself in this instance, and there was not enough will in the community to expel her. Another community member was accused of infidelity while she was working at a local bar in the town of Ivirgarzama. This compromised her standing in the community, but did not result any official action. Regardless of whether or not these individuals were actually responsible for violating any social norms (or whether or not the social norms are themselves legitimate), these incidents reflect a lack of community cohesion. Between the bifurcation between *madereros* and non-*madereros*, and the demonstrated inability for collective action against a universally perceived injustice by the non-*madereros*, a variety of heterogeneities within the community conspire to preclude collective action with respect to natural resources, and community governance in general.

Cururú exhibits a very different user-group structure. All households in the community are involved in timber extraction, albeit to varying degrees. In spite of this, an elite group has still consolidated around control of forest resource management. As in TIM Ivirgarzama, these individuals are all closely related, and comprise one family. Three individuals in particular make

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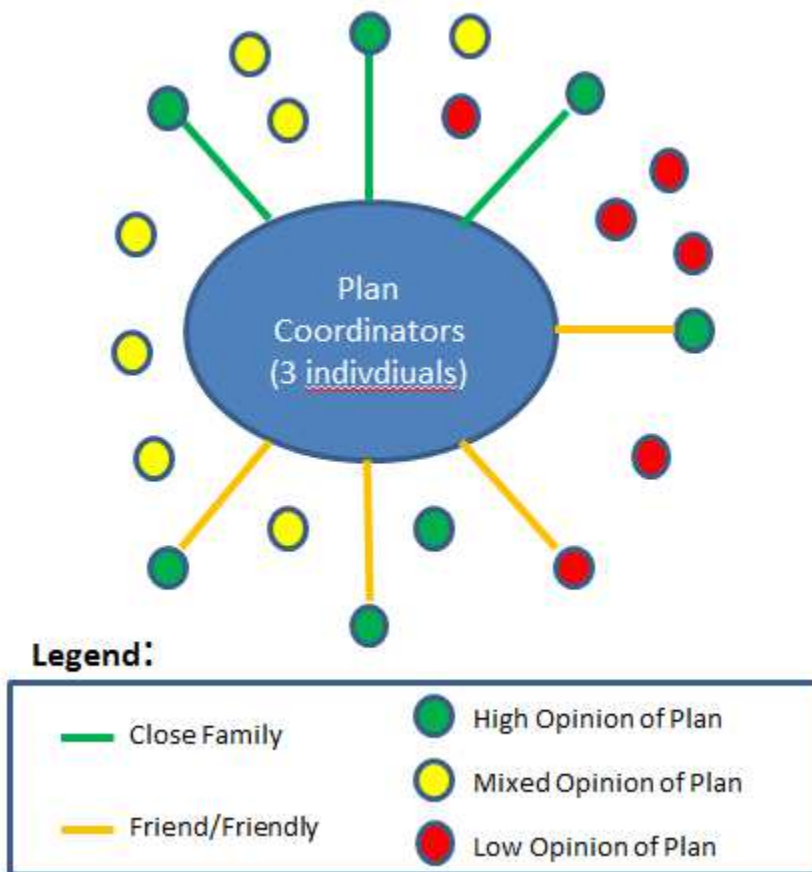
<sup>23</sup> One notable exception to this involves the *de facto* expulsion of one member from the user-group due to chronic alcoholism, incompetence, and trouble-making.

all key decisions with respect to forest management, including harvesting decisions, and hiring decisions. Since wage labor from working on timber extraction crews is by far the principal benefit that the community receives from the indigenous management plan, this decision making authority is very important.

Opinions of the indigenous management plan in Cururú were mixed in spite of all community members benefiting from the plan. Conversations with households revealed a likely relationship between households' relationships with the three individuals principally responsible for forestry decision-making, and satisfaction with the plan. The principal sources of dissatisfaction with the plan were (1) households believed they were not being provided with enough work, and (2) there was limited transparency and information concerning forestry decision making. Figure 4.10 shows a social network map of Cururú.

Households that expressed satisfaction with the plan are shown as green circles; household with mixed feelings about the plan are shown as yellow circles; and households with exclusively or overwhelmingly negative views of the plan are shown as red circles. Green line segments depict a close familial relationship between a household and the individuals that control forestry decision making (a "close" relationship is defined as a first cousin, sibling, or parent in the household). Yellow line segments represent a close friendship with these individuals, which was assessed by field observations. These individuals were seen spending evenings, generally drinking local alcoholic beverages with the forestry decision makers.

**Figure 4.10 The Cururú Network**



Of the seven households with close connections to the decision makers, six have a high opinion of the plan. According to the head of one of these households – a cousin of the forestry decision makers and chainsaw operator for the indigenous management plan, “Thanks to the indigenous management, plan, we have reliable work for all community members. We are strict about keeping our forest management sustainable. We have a very large area of over 16,000 hectares, we only harvest a small number of trees every year, and we are aggressive about planting new trees to replace the ones that we take.” Operating a chainsaw is a particularly desirable position, and it pays more than other work crew jobs. This individual and his sons reliably have work with the indigenous management plan, and do not seek work outside of the community.

By contrast, the lack of transparency and perceived unfairness in the distribution of work hours perturbed some community members. A respondent from such a household, who was a vocal proponent of the plan when it was created in 2001, explained:

“We’re happy that the plan provides some work in the community, because [my husband] is 63 years old and it would be hard for him to travel outside to find work. However, the profits from the plan are supposed to be invested in education, health and infrastructure for the community, but they haven’t done this. Also, there isn’t always enough work to be had, and not everyone gets the same amount of work. The costs and revenues and amount of trees that they harvest are not been shared with us – the plan does not have transparency<sup>24</sup>.”

Other households expressed similar sentiments, and one also explained that it those who felt that the plan was not administered fairly didn’t feel comfortable expressing this view, because they ultimately needed however many days of wage labor they could get. Exacerbating conflict over this issue could put them at risk of being granted even fewer days of work, and no one else in the community had the technical skills to manage the operation. This is in part because the three individuals who control forestry decision making were selected to be trained by BOLFOR, the USAID funded NGO that helped the community to create and operationalize their plan in the first place.

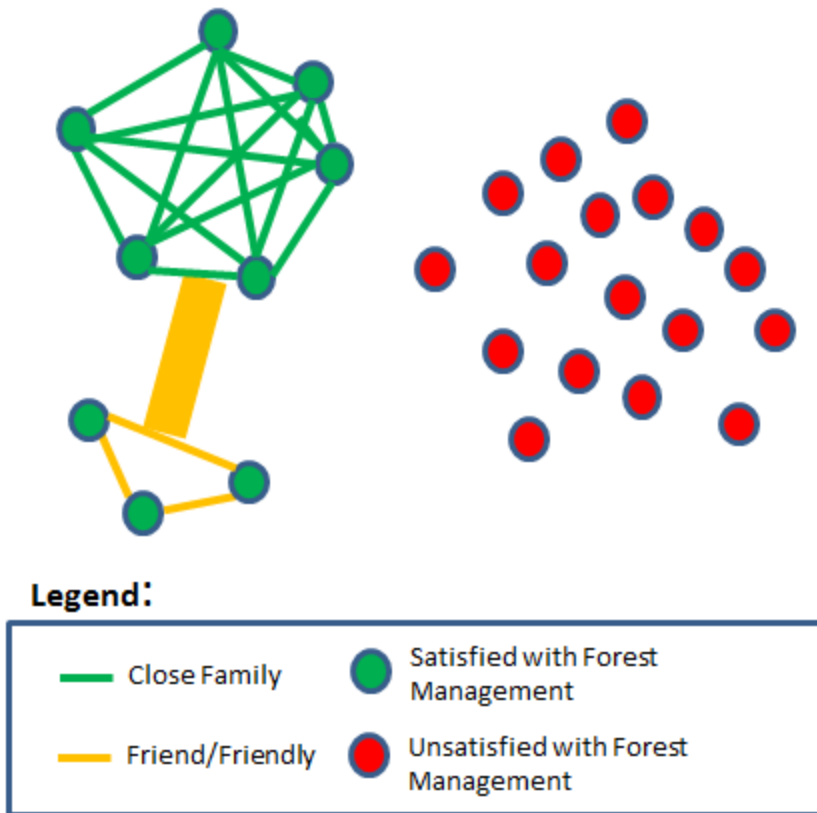
This scenario contrasts with TIM Ivirgarzama, where the network looks very different (Figure 4.11).

#### **Figure 4.11 – The TIM Ivirgarzama Network<sup>25</sup>**

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<sup>24</sup> “Transparency” (transparencia) was indeed the precise word that was offered by the respondent.

<sup>25</sup> There are unmarked close familial relationships between the non-*madereros*. However, they do not form anything resembling a unified extended family.



Two qualitative differences stand out. First, the bifurcation between *madereros* and non-*madereros* is stringent, and the resultant network-based inequality has very obvious consequences for the community in terms of forest governance outcomes. Second, even the individuals who are not connected to the forestry elites in Cururú still benefit from the plan, whereas non-*madereros* in TIM Ivirgarzama are completely excluded from any benefits from timber.

#### 4.9 Inequality, Heterogeneity, and Forest Governance

The results from the above analyses suggest that (1) economic inequality is not necessarily captured by income and expenditure metrics, (2) network-based inequality is influenced by



social heterogeneity (including ethnic heterogeneity), and differs between communities and (3) network-based inequality may be a key proximate driver of forest governance outcomes.

Cururú clearly performs better than TIM Ivirgarzama with respect to forest governance outcomes. In Cururú, all members of the community derive at least some benefits from collectively owned forest resources; in TIM Ivirgarzama, only a minority does. In Cururú, Forest extraction is planned, and implemented according to sustainable management criteria; in TIM Ivirgarzama the only plan for extraction is rhetorical, and sustainable practices are not attempted. In Cururú, a few individuals control key forestry decision making, and allocate benefits preferentially to people within their network; in TIM Ivirgarzama, individuals not in the network of *madereros* receive no benefits whatsoever, and are categorically excluded from the resource in spite of having an equal legal title to it.

Economic inequality exists in both communities; given the finding from the previous chapter, that economic inequality is, at the county level, moderated by land titling with respect to at least forest condition change, a central question that remains: did the formal titling process moderate the adverse effect of inequality on collective action? In the case of Cururú, it is clear that a formal title permitted the formation of an indigenous forest management plan in the first place. In many respects, inequality is simply not that extreme in Cururú. Economic inequality as measured by income is fairly high, but cash incomes aren't so important for the community. All community members have ample land to grow crops on. Asset inequality is present (as with chickens), but this along with other forms of economic inequality are mitigated by social capital derived from a generally cohesive group. The community is ethnically homogenous, has a shared minority language, and is moreover relatively remote. These sociocultural homogeneities, along with lower economic inequality to begin with, have mitigated the potential for network-based

inequality to form. To the extent that it does exist, the capacity for the forestry decision makers to capture benefits is mitigated by (1) social cohesion, capital and sanctions, and (2) that community members have not only *de jure* rights to forest resources, but also *de facto* rights that are enforced by a variety of institutions.

Social cohesion, capital and sanctions themselves make it very difficult for egregious further exclusion of Cururú community members without close connections to the forestry decision makers to occur. While there is some discontent within the community over perceived unfairness, it would not be acceptable for a household to be cut off from work entirely. Even though the forestry decision makers appear to capture a disproportionate share of the benefits, they at least rhetorically see the role of the indigenous management plan as one of sustainable management and community rights security, both now and into the future. According to the community cacique (president), who is also one of the forestry decision makers, “The indigenous management plan lets us use our forest sustainably, and ensure our children and their children can also have this right. The forest is for the Guarayo people, and we are Guarayo people.” This perspective is shared by the community, and there is a consensus that in spite of its shortcomings, the indigenous management plan has been good for the community.

Second, while both TIM Ivirgarzama and Cururú community members have *de jure* rights to their forest resources, the community members of Cururú see much stronger *de facto* enforcement of these rights. This is due to a more robust institutional design wherein forest governance is carried out through multiple linked governance organizations. These organizations include the community government, AIMCU, the Guarayo TCO, and also the forest superintendent.

In TIM Ivirgarzama, neither social cohesion, capital, and sanctions nor effective *de facto* enforcement of community members' *de jure* property rights are strong. The result is that, in a context of relatively high economic inequality and sociocultural heterogeneity, a high degree of network-based inequality has emerged. Illegal logging, a certainly inequitable and likely sub-optimal distribution of forestry benefits has been realized, and forest degradation has been exacerbated.

#### **4.10 Discussion**

The findings of the comparative case study suggest that in the two communities under study, formal titling did not automatically create favorable conditions for collective action, and the adverse relationships between other forms of inequality and heterogeneity and collective action were not equally mitigated in both instances. Moreover, an examination of these two communities shows that to the extent that economic inequality is indeed a driver of network-based inequality and collective action outcomes, income inequality may not capture all relevant processes at this scale.

It was found in the previous chapter that forest degradation is associated with income inequality, but land titling may moderate this effect. This comparative case study does not provide strong evidence that titling alone moderates the effects of inequality, but the hypothesis remains plausible. While in a large-*n* analysis it is possible to use variation among parameters of interest as a proxy for the unobservable counterfactual, this is not an option in a comparative case study (nor is it the goal). It is impossible to say what forest governance outcomes would be like in Cururú or TIM Ivirgarzama if neither community had a formal title to their land through INRA. Nevertheless, this assessment provides evidence for the following:

- (1) Economic inequality is not effectively assessed by income and expenditure data, which is the most common approach used by international organizations, as well as many scholars (Arias and Robles 2007).
- (2) Network-based inequality is an emergent property in both communities, and it is an important driver of collective action and ultimately forest governance outcomes. Belonging to particular networks can confer benefits and privileges that are not conferred by wealth, ethnicity, or other factors on their own.
- (3) Network-based inequality may be moderated by other types of inequality, including sociocultural heterogeneity, economic inequality, and institutional arrangements.
- (4) Issuing communities with formal land titles is not a panacea for local governance of forest resources, and other local conditions necessarily mediate its effectiveness.

The institutional arrangements in the latter point play an important role in both communities, and are analyzed in detail in the following chapter. Whereas in TIM Ivirgarzama, the community assembly is relatively weak, and is not checked by other community institutions, the Cururú community assembly exists alongside AIMCU, and within the context of the Guarayo TCO.

A key implication of this comparative case study is that while titling may moderate the influence of other types of inequality on forest degradation by consolidating social capital that facilitates collective action, it is hardly a silver bullet. This case demonstrates that two communities with formal titles to their land can produce strongly divergent outcomes. Inequality is one important component of this. At the local level, network-based inequalities in addition to economic inequality and *de jure* land-based inequality are key proximate drivers of collective action.

Cururú has a number of factors that may contribute to reduced network-based inequality, and

overall better forest governance. Institutional arrangements have been shown in the literature to be particularly important determinants of forest governance outcomes. Furthermore, the institutional arrangements between Cururú and TIM Ivirgarzama present some obvious differences. To what degree are these institutional differences responsible for the different outcomes and processes observed in each community? The subsequent chapter examines the institutions found in these communities in more detail in order to answer this question, and also links the findings from these communities back to the earlier county-level analysis.

## **Chapter 5 - Institutional Design as a Driver and Mediator in Forest Systems: Lessons from Communities and Municipal Analysis in Bolivia**

### **5.1 - Introduction**

Nobel laureate Douglas North defined institutions broadly as “the formal and informal rules that constrain human behavior” (North 1990). In the context of forest governance – and the governance of natural resources in general – institutions entail formal and informal property rights, the *de facto* and *de jure* specification and enforcement of these rights, the organizational networks that exercise authority over forest resources, national and sub-national laws and policies, and local rules-in-use. A large body of scholarship has described a variety of principles for effective institutional design for natural resource governance, including the governance of forest resources (e.g., Agrawal and Angelsen 2009; Quinn et al. 2007; Agrawal and Chhatre 2008; Klooster 2000; Pagdee et al 2000; this literature is more thoroughly reviewed in Chapter 2)

Agrawal and Angelsen (2009) drew from previous literature, including the many-decades long body of work of Elinor Ostrom and her colleagues (see also Ostrom 2009). The institutional factors that they identified include rules that are easy to understand, locally-devised rules, tenure

security, and effective local enforcement of sanctions. In addition to influencing forest governance outcomes directly – including livelihoods and forest condition change – institutional design can be a critical mediator of other contextual factors including inequality and heterogeneity (Andersson and Agrawal 2012). In particular, recent scholarship has emphasized polycentric governance, and the interactions between multiple centers of authority and decision-making to be qualitatively critical in shaping the performance of forest governance (Andersson and Ostrom 2008; Ostrom 2010). In general, these studies have shown polycentric governance to be largely beneficial for forest governance, due in part to the resilience conferred to the system by the existence of redundancies. The intuition behind this is simple: if all organizations have some weaknesses and capacity for failure, then having multiple organizations that perform similar functions and can compensate for each other's shortcomings should bolster institutional capacity and improve forest governance.

The lowland Bolivian communities of TIM Ivirgarzama and Cururú are similar in many respects. They are similar in population size, physical size, and forest resource value. They differ in some contextual respects, having different flavors of inequality and heterogeneity, disparate connectedness to outside markets, and distinct histories. Furthermore, the institutional context of these communities differs considerably. This comparative case study investigates the degree to which institutional design in these two communities has contributed to disparate institutional performance. By and large, Cururú has superior forest governance outcomes to TIM Ivirgarzama. In Cururú, elite capture occurs to a lesser degree, a sustainable forest management plan exists and is operational, and overall community satisfaction with forest governance is higher. This chapter seeks to answer the following questions: to what extent are institutions – the formal and informal rules that constrain human behavior – responsible for these differences?

More particularly, how can institutional design mitigate the adverse effects of inequality on the collective action that facilitates good forest governance?

The remainder of this chapter is organized as follows. First, some background on institutions and organizations as terminologies is provided. Second, the institutional context of each community is described<sup>26</sup>. Third, the relationships between the communities' institutional contexts and their respective forest governance outcomes are assessed comparatively. Fourth, the findings are synthesized and further hypotheses related to institutional design are generated. Fifth, these hypotheses are tested empirically in a broader context, using county-level data from the Bolivian lowlands. Finally, implications are discussed.

## **5.2 Institutions and Organizations**

Institutions - the formal and informal rules that constrain the behavior of actors – can be thought of as the “rules of the game.” While the term “institution” is often used colloquially to refer also to “organizations,” here they are treated as distinct. Organizations are considered actors whose behaviors are constrained and governed by institutions – they are, in a sense, some of the “players” in the game that is defined by institutions (North 1990). At the same time, the formation of organizations necessarily affects institutions. Communities that create local elected organizations that are endowed with particular rights and obligations, for example, have affected their institutional context as well by changing what powers are granted to which actors. A forest system in which a community-based organization with a locally elected leadership makes

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<sup>26</sup> The previous chapter provides a more comprehensive history of each community. The institutional history of each community is explained therein, and there is overlap between these sections. For a more complete treatment of the histories of these two communities, refer to the previous chapter. These sections focus on the contemporary institutional layout, elaborating salient organizations, rules-in-use, and inter-institutional linkages.

decisions about forest management is *institutionally* different from a forest in which the county government makes all forest management decisions.

### **5.3 Comparative Case Study Data and Approach**

The IFRI (International Forestry Resources and Institutions) research network has collected data in both communities on several occasions in the past 15 years with support from the Bolivian NGO CERES Bolivia (*Centro de Estudios de la Realidad Social y Economica*; English: Center for the Study of Social and Economic Reality). The IFRI methodology for data collection is designed to be flexible, and capture rigorously a variety of disparate local social-ecological contexts. A revisit to both sites was conducted between June and July of 2012, and the IFRI protocol was applied.

CERES Bolivia has a long history of collaboration with the IFRI network, and has developed a number of important in-house strategies for collecting relevant data. These include:

- (1) Constructing an agricultural calendar with community members to understand what crops are important, in addition to how, when, and where they are grown
- (2) A participatory mapping exercise to ensure that the community limits, and the forest limits are clearly understood
- (3) A community meeting wherein local peoples' opinions are solicited on the most pressing challenges that they face with respect to forest governance and other topics
- (4) Community-led institutional mapping, wherein key organizations and actors are diagrammed in relation to each other.

Throughout this process, key informants from the community are consulted to provide qualitative background information and context, and also to discover key facts about the



community, the forest, and the local people. Information concerning the institutional context and history of the communities was obtained through these methods between June and July of 2012.

#### 5.4 Cururú: Institutional and Organizational Context

In Cururú, there are multiple organizations that play a role in forestry. Table 5.1 describes these organizations and summarizes their role in the local governance of forest resources.

**Table 5.1 Forest Governance Organizations of Cururú**

Organization	Level	Description
Forestry Superintendent (SIF)	National	The Forestry Superintendent (SIF) oversees and approves all forestry activities in Bolivia. Any timber extraction must be approved by SIF.
National Institute of Agrarian Reform (INRA)	National	INRA, created by the land reforms of 1996, is responsible for granting and enforcing titles for indigenous lands, including the Guarayos TCO.
Confederation of Indigenous Peoples of Bolivia (CIDOB)	National, Regional	CIDOB is an indigenous peoples' organization that lobbies for land rights in the lowlands.
Center for Guarayo Native Peoples' Organizations (COPNAG)	Regional	COPNAG is the organization that governs the Guarayos TCO, and approves and coordinates community forest management plans. Community territories within the TCO are specified and enforced by COPNAG.
Guarayos Native Community Territory (Guarayos TCO)	Regional	The Guarayos TCO is the land that has been conferred to the Guarayo people by the Bolivian government. It is administered by COPNAG, and its title is specified and enforced by INRA's authority.
Cururú Community Government ( <i>cabilde</i> )	Local	The Cururú community government, or <i>cabilde</i> , is a local executive body with individuals elected to positions including: president, vice president, and secretary of land and territory
Cururú Community Assembly	Local	The community assembly is the forum in which all adult community members meet to vote on local issues including inter-community relationships, forest management, risk management, and community projects
Indigenous Timber Association of Cururú (AIMCU)	Local	The governing body for the indigenous management plan. Its coordinators are elected by the community assembly. In practice, three closely related men control the AIMCU decision-

		making process.
Center for Indigenous Guarayo Women (CEMIG)	Local	The community's organization for women, which serves as a forum for women to meet to discuss issues that are important for women.
BOLFOR	Local	A local NGO that is no longer active, but played a central role in supporting the community in its elaboration of the indigenous management plan

There are therefore ten organizations that are (or have been) involved in forest governance in Cururú. These organizations jointly specify and enforce the rights of community members to forest resources, and there are redundancies, checks, and balances between them. COPNAG, the organization that administers the Guarayos TCO, is well organized. The organization was formed in 1997, right after the agrarian reform was passed that permitted indigenous peoples to petition for land rights. After being granted lands, organized timber extraction was quick to follow, with COPNAG taking the lead in soliciting authorization for the community. The Guarayos TCO has, through COPNAG, been effective at developing plans for the exploitation of its natural resources, and at obtaining approval for these plans in a streamlined way.

At the local level, AIMCU and the Cururú community government have forest management authority. Because the *cabilde* positions can be occupied by different individuals than those who administer AIMCU, more individuals have at least some influence over forest management decision making. In practice, the three individuals who control AIMCU have most of the power, and capture some of the benefits; individuals with close connections to these people may be given more days on timber extraction work crews, and are generally more satisfied with the indigenous management plan (see Chapter 4 for a detailed treatment of this network-based inequality in Cururú).

The community assembly serves as an additional locus of governance, and has some capacity to act as a check on AIMCU's authority. According to the president of the local women's organization (CEMIG), "During the last assembly I mentioned that I was concerned that the profits from the forest management plan were not being put towards schools and other local projects." She was able to voice this opinion, and have her voice heard, in some part due to the existence of CEMIG. While other community members mentioned that they were not generally empowered to voice strong objections to the management plan for fear of being denied much-needed work (see Chapter 4), the community assembly nevertheless serves as a check on AIMCU's power.

Finally, the NGO BOLFOR played an instrumental role in elaborating the community's indigenous forest management plan. With USAID dollars and technical expertise from outside the country, members of the community were able to formally develop a plan, and through this process understand collectively the goals and practices of the management plan. In general, there is *de facto* enforcement of community members *de jure* rights to their forest resources. The rules that govern the community's use of the forest, while enforced directly by AIMCU, were constructed with the input of other organizations and continue to be checked by these local institutions.

These *organizations* shape the *institutional* context of forest governance in Cururú. The presence of multiple organizations creates a situation in which there are overlapping spheres of influence. The rules-in-use with respect to

## **5.5 TIM Ivirgarzama: Institutional and Organizational Context**

Fewer organizations are directly involved in TIM Ivirgarzama's forest management. Table 5.2 summarizes the organizations that are relevant to forest governance in TIM.

**Table 5.2 – Forest Governance Organizations in TIM Ivirgarzama**

<b>Organization</b>	<b>Level</b>	<b>Description</b>
Forestry Superintendent (SIF)	National	The Forestry Superintendent (SIF) oversees and approves all forestry activities in Bolivia. Any timber extraction must be approved by SIF.
National Institute of Agrarian Reform (INRA)	National	INRA, created by the land reforms of 1996, is responsible for granting and enforcing titles for indigenous lands, including TIM – TC.
Confederation of Indigenous Peoples of Bolivia (CIDOB)	National, Regional	CIDOB is an indigenous peoples' organization that lobbies for land rights in the lowlands.
Multiethnic Indigenous Territory of the Cochabamba Tropic (TIM –TC)	Regional	TIM –TC is a territory that was recognized as a TCO via INRA. It is geographically discontinuous, and the member communities have little interaction
TIM Ivirgarzama Community Government	Local	The TIM Ivirgarzama community government is the local executive body with individuals elected to positions including: president, vice president, and secretary of land and territory, secretary of sport, secretary of culture, and other positions
Jatun Sacha	National	An NGO supported by USAID that aimed to support peasant agriculture by providing seeds and technical support. Jatun Sacha began to work with TIM Ivirgarzama to elaborate a forest management plan, but it never strongly materialized.

The community was formed as part of a geographically discontinuous entity (the Multiethnic Indigenous Territory of the Cochcabamba Tropics, or TIM – TC). The Ivirgarzama-Yuracaré people who founded the community were a relatively small group, coordination among families and groups was necessary for TIM – TC to form. Relationships between the disparate communities were weak, and ties remain loose. TIM – TC, as a result, does not coordinate activities, forestry-related or otherwise.

In spite of this, there was an attempt to consolidate an indigenous forestry management plan in the early 2000s. The NGO Jatun Sacha, funded by USAID and the United Nations Food and Agricultural Organization (FAO) worked with the community on two projects. These included (1) a chocolate agroforestry project, wherein community members were provided with seeds and technical support to grow chocolate, and (2) an indigenous forest management plan. The indigenous forest management plan for TIM Ivirgarzama was partially elaborated between 2003 and 2007. The land that was designated for forest management (above the green line in Figure 5.1) was north of the community's agricultural land and settlement.

**Figure 5.1 - TIM Ivirgarzama Community map<sup>27</sup>**

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<sup>27</sup> The land to the south of the green line is where community members live (when they aren't staying in the town of Ivirgarzama) and grow crops. The area to the north and northwest is where the indigenous management plan was proposed to operate.



The indigenous forest management plan never materialized for a number of reasons. First, Jatun Sacha stopped its operations in 2007, as the Morales government began to phase out USAID funded operations. Second, another community called Lagunillas had been using the land to the north of the green line, and maintained *de facto* control over the land in spite of the TIM Ivirgarzama communities *d de jure* title via TIM – TC. According to one community member, who is not part of the *maderero* group that extracts timber from various parts of the territory to the exclusion of other community members (see Chapter 4 for a detailed description of this user group, and the network-based inequality that has formed surrounding it), “We tried to evict the Lagunillas users through a court, but nothing ever happened, and our case was never heard.” Other community members echoed the sentiment that the community’s *de jure* claim to this land had little *de facto* enforcement. Furthermore, the same community member – not uniquely - speculated that the *maderero* group had gone so far as to strike a deal with the Lagunillas community, wherein they would simply extract timber from the northern sector of the community, not inform any other community members, and receive a payment from Lagunillas to permit them to continue occupying the land for coca-growing and other agricultural activities.

The TIM Ivirgarzama local government and community assembly provide a platform for community members to participate in locally relevant decision making. However, forestry related issues are almost never brought up at the assembly, because the community has virtually no institutionalized forest governance. According to community members, there is still technically a requirement that 10% of any profits from timber sales must be shared with the community; the *madereros* do not, however, comply with this rule, and there was no evidence of *de facto* recognition, let alone enforcement, beyond community members mentioning that it was discussed many years ago.

## **5.6 Institutional Comparison of Cururú and TIM Ivirgarzama**

### **5.6.1 Principles of Institutional Design**

Agrawal and Angelsen (2008) proposed, based on existing literature, a set of institutional characteristics that lend themselves to effective community-based forest governance. Table 5.3 summarizes the institutional characteristics that they identify, and the complete table of all characteristics is presented in the Appendix to this chapter. Each success-linked factor in this table was evaluated qualitatively with the input of local experts on a scale of 1 – 5. A score of ‘1’ indicates that the factor is not present in the community; a ‘2’ indicates that the factor is barely present in the community; a ‘3’ indicates that the factor is somewhat present in the community; a score of ‘4’ indicates that the factor is definitively present in the community; and a score of ‘5’ indicates that the factor has a very strong presence in the community.

Cururú was given a higher score than TIM Ivirgarzama in all of these categories, and Cururú’s average qualitative score for institutional performance was 3.1, to TIM Ivirgarzama’s 1.6. In the evaluation of some of these factors, the importance of polycentric governance emerges. For

example, accountability is higher in Cururú because there are multiple elected bodies with overlapping authority. In addition, *de facto* tenure security is enhanced by the presence of multiple governance organizations in Cururú. The complete capture of forest control by elites is simply not possible, because all community members were involved in the discussions that precipitated the formation of the indigenous forest management plan by way of the assembly.

In TIM Ivirgarzama, community members cannot count on *de facto* tenure enforcement of their legally guaranteed rights to forestry resources. Network-based inequality effectively excludes *non-madereros* from participation in any forestry activities, and there is no effective recourse through any available governance organizations. Even more concerning is that there is reason to believe that some forestry elites within this community have extra-legal arrangements with neighboring communities that effectively share benefits of illegal logging, to the exclusion of other community members that have strong *de jure* claims to these benefits.

**Table 5.3 Institutional Comparison of TIM Ivirgarzama and Cururú**

<b>Characteristic</b>	<b>TIM</b>	<b>Distribution</b>	<b>Cururú</b>	<b>Description</b>
Rules are easy to understand and enforce	1	There is no mechanism for rule enforcement. Timber is extracted where convenient, and benefits are not shared in spite of agreement that they ought to be.	4	There is a systematic procedure in place to mark trees for extraction based on size, to exclude trees from extraction based on the same, and to plant key species.
Rules are locally devised	3	Forestry rules are unclear. Benefit sharing was discussed, but not enforced.	4	Rules are devised by the indigenous management plan, albeit with influence from BOLFOR.
Rules take into account differences in violations	1	Violations are not sanctioned at all.	2	There are not many rules that can practicably be broken by individuals.



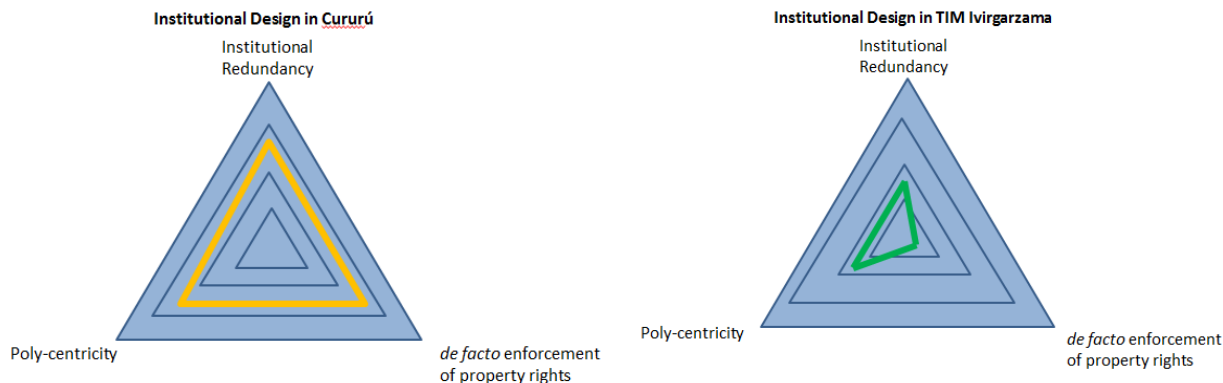
Rules help deal with conflicts	1	There is no mechanism for dealing with conflict outside of the assembly, wherein discussions of conflicts tend to stall without resolution.	3	Multiple elected bodies and a general assembly jointly adjudicate conflicts, with appeal to higher authority as an outside option.
Rules hold users and officials accountable	1	See above; there is no effective accountability in the community	2	There is some cross-organizational accountability, with checks and balances.
Effective local enforcement and sanctions	1	See above	2	There is no evidence of monetary sanctions, but social sanctions would likely occur if the forestry decision makers attempted to exclude any community members entirely.
Tenure security	2.5	The community is not at risk of eviction or forced removal, but they are also unable to defend their territory effectively against the community to the north.	4	The community is very secure in terms of land tenure, and has plenty of land for the number of households in the community. Social capital and multiple organizations ensure <i>de facto</i> enforcement of <i>de jure</i> rights.
Capacity to exclude outsiders	1	They are unable to excluded outsiders at all	5	They have successfully excluded another community from using their land

The capacity to exclude outsiders, and ensure that property rights are indeed well specified and enforced, is similarly weak in TIM Ivirgarzama compared to Cururú. One third of the households that were surveyed in TIM Ivirgarzama believed that timber extraction was permissible for any household, in any part of the community; the other two thirds believed that private extraction of this kind was categorically not allowed. This lack of clarity in the specification of the rules is matched by the lack of enforcement.

### 5.7 Institutions as Mediators of Inequality: Further Hypotheses

This comparative case study demonstrates that by virtue of history and contextual factors, the communities of TIM Ivirgarzama and Cururú have managed to create two very different institutional environments, populated by different types of organizations and characterized by different rules and regulations. Compared to TIM Ivirgarzama, Cururú has many organizations involved in forest governance, includes redundancy between these organizations that permits more effective *de facto* enforcement of property rights, and polycentric governance with more than one locus of control. Performance on these three measures can be assessed for each community. Such an assessment is shown below in Figure 5.2, which qualitatively depicts how the two communities ‘score’ on these three axes.

**Figure 5.2 – Institutional Redundancy, Poly-centricity, and Property Rights Enforcement in Cururú and TIM Ivirgarzama**



The case of Cururú demonstrates how institutions can strengthen the *de facto* enforcement of property rights. Institutional redundancy and polycentric governance may produce mutually reinforcing rules-in-use that prevent complete elite capture of benefits, and ensure that community members benefit from rights and resources that they have a formal *de jure* claim to. Institutional redundancy is related to, but distinct from, *organizational* redundancy. Having multiple organizations engaged in similar activities does not on its own affect the institutional context of forest governance. However, the character of the organizations studied here –

particularly those involved in forest management, accountability, and key decision processes – have institutional consequences. In Cururú, there are multiple community-level organizations that are elected and hold real power in forest governance. The institutional effect of this is that community members have more direct participatory involvement in forest governance, and are have institutional avenues to affect changes in forest governance regimes and to assert *de facto* claims to *de jure* property rights. It is important to distinguish between organizational plurality and institutional redundancy. A plurality of organizations that are not directly involved in shaping the rules-in-use for forests may have drastically different effects on forest governance outcomes than having a multitude of redundant decision-making organizations at multiple levels. There is evidence from other contexts that institutions do indeed play a key role in producing *de facto* enforcement of property rights. Gibson and Lehoucq (2002) conducted a comparative study of five communities in Guatemala, two of which were privately owned and three of which were communal. They found that the variation in forest condition change within *de jure* property rights classes was greater than the variation between them. Instead, they argue that local rules-in-use play a paramount role in shaping forest outcomes. In particular, rules were effectively constructed to constrain overexploitation of forest resources in one community, but not in others.<sup>28</sup> From this finding, they make the case that *de jure* property rights specification is a very poor predictor of forest governance outcomes, and that rules-in-use and institutions are far more important. Without local institutions to direct the governance of natural resources, and provide *de facto* property rights enforcement, *de jure* property rights are of little utility.

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<sup>28</sup> In fact, Gibson and Lehoucq suggest that the construction of these institution was actually spearheaded by elites á la Olson effects (Olson 1965). Olson effects suggest that groups that stand to gain more from the capitalization and development of a resource will take on a disproportionate share of the associated costs, even if there is a known risk of free-riding by other users.

While some studies have suggested that polycentric governance and institutional redundancy are useful principles of institutional design (Andersson and Ostrom 2008; Ostrom 2010) that may promote better forest governance outcomes, other studies suggest otherwise. Johnson and Forsyth (2002) examined titled community forests Thailand, and found that elites ended up conspiring with elites from the communities themselves, along with local governments and regional governments, to capture even more completely the benefits of forestry. Similarly, in Indonesia, decentralization multiplied the number of organizations involved in forestry at the local level. Prior to the reforms in Indonesia, illegal logging networks involved relatively few actors, but were somewhat vulnerable to sanctions from the national government. After the reforms, elites continued to capture forestry rents through these illegal logging networks, and leveraged new power vested in local government officials to strengthen their capture of forest resources (McCarthy 2002; Engel and Palmer 2008). These cases, and other cases that posit a more desirable relationship between multiple overlapping institutions and natural resource governance outcomes (Andersson and Ostrom 2008; Ostrom 2010; Lubell et al. 2002) all focus on loci of governance at the county level or higher. It is important to note that the multiplicity of organizations involved in forestry found in Cururú included institutionally redundant community-level institutions. There may be differences between institutional redundancy in general, as compared to institutional redundancy in the context of small forest communities.

This analysis presents the following question: to what extent does institutional design shape forest governance outcomes outside of these communities? The above comparative analysis suggests the following hypothesis: institutional redundancy and polycentric governance facilitate stronger *de facto* enforcement of *de jure* property rights.

Two specific predictions follow: (1) institutional redundancy and polycentric governance will positively moderate the effect of *de jure* community titling on forest outcomes and (2) institutional redundancy and polycentric governance will be associated with better forest outcomes directly by making the system more resilient and stable. To the extent that the effects observed between Cururú and TIM Ivirgarzama are generalizable, they are expected also be observed at the county level in Bolivia in general.

An alternative hypothesis, as suggested by Johnson and Forsyth (2002) and Gibson and Lehoucq (2002) is that the presence of multiple levels and loci of governance may provide further opportunities for elites to capture benefits and preclude effective collective action by *diminishing* the *de facto* enforcement of *de jure* property rights. A prediction that follows from this hypothesis is that institutional redundancy will negatively moderate the effect of *de jure* community titling on forest outcomes.

## **5.8 Municipal Analysis Data**

Data was collected in 50 counties in Bolivia in 2001 and in 2007. Data from 2007 is used in these analyses. County level officials in key positions were surveyed, including the head of the municipal forestry units (UFMs) and the community representatives in the vigilance committees (CVs). These individuals reported information on forest governance, forest condition change, forestry activities, and other municipal characteristics.

### **5.8.1 Independent Variables**

The degree to which forest governance is “polycentric” was measured as the number of organizations with hired staff involved in forestry. Forestry officials reported the number of employees and staff involved in forestry from (1) the central government, (2) the regional

government, (3) local communities, (4) local non-governmental organizations, (4) global organizations, and (5) private firms. Binary variables were constructed to reflect whether or not each of the aforementioned sectors and levels of government were represented in forest governance at the county level, and a simple count variable was generated to reflect the number of organizations involved in forest governance.

*De jure* property rights were measured by (1) the percentage of communities that have formal titles to their land<sup>29</sup> and (2) the percentage of communities that have permits to extract timber. These both reflect different levels of ownership: formal titles confer exclusion, management, and use rights. Permits, on the other hand, do not necessarily confer exclusion rights, and may have only limited management rights.

Table 5.2 summarizes these two independent variables, along with an important control – the percentage of land in a county that is devoted to agriculture. This control was used because it is a key indicator of the importance of forest resources in a county. When more land is dedicated to agriculture, less land is generally forested ( $r = -0.3, p < .01$ ). Other controls were also used during the model specification process<sup>30</sup> but none of them increased the power of the models, and were ultimately not used for analysis.

**Table 5.2 Independent Variables Used in Analysis**

Variable	Obs	Mean	Std. Dev.	Min	Max
Number of Organizations in Forestry	45	2.244444	1.811021	0	6

<sup>29</sup> These are either as indigenous territories themselves (TCOs) or community titles within such indigenous territories.

<sup>30</sup> These include population, poverty as measured as average household expenditures, inequality (the Theil index), percent forested area, and the level of influence that peasants and indigenous communities are reported to have on the local government.

% communities with titles	39	59.94872	32.7486	0	100
% communities with permits	40	26.725	37.43232	0	100
% municipal land used for agriculture	40	31.2	20.63629	2	70

Interaction terms were constructed between (1) the number of organizations in forestry and the percentage of communities with titles, and (2) the number of organizations in forestry and the percentage of communities with permits. The interaction term was constructed using centered independent variables, in order to reduce multi-collinearity. The interaction was used to test the prediction that polycentric governance and institutional redundancy will be associated with a greater positive effect of land titling and permitting on forest outcomes, through the hypothesized mechanism of conferring *de facto* enforcement of *de jure* property rights.

### 5.8.2 Dependent Variables

The key dependent variables used in these analyses were (1) forest condition change from 2002 – 2007, and (2) income from forestry normalized to the municipal population. Multiple outcomes are of interest in forest governance (see Section 1.3), including livelihoods, equity, and forest condition change. At the county level, forest condition change is of interest to many actors and scholars alike, because the linkages between different organizational landscapes and institutions must be well-understood to effectively inform conservation and management policies. Similarly, incomes from forestry are useful – but problematic for a number of reasons – in measuring livelihood impacts. Incomes from forestry at the county level are limited as measures of livelihoods because (1) the distribution of these incomes is not obvious from aggregate figures, and (2) the degree to which illegal logging contributes to incomes may be masked by official figures. Nevertheless, official measures of forestry incomes reveal the degree to which formal sector forestry activities are important. Examining these figures on a per-capita basis at the county level does not reveal how much income the average individual in a county receives from

forestry activities, but it does show how much of the local economy is linked to forestry. Thus, it is used here as a dependent variable to shed light on the linkages between organizational landscapes, institutions, and forestry activities at the county level.

Forest condition changes were reported by key informants from the municipal forestry units, who are informed about and engaged with local forestry operations. They reported change on a scale of 1 – 5, with a value of ‘one’ reflecting great improvement in forest resource condition, and a ‘five’ reflecting great degradation of the forest. Income from forestry was reported by both the informants from the municipal forestry units and also the vigilance committees. Their responses were quite similar ( $r = 0.78$ ,  $p < 0.001$ ), and when both were available for a county an average was taken. This average was normalized by the municipal population and logged in order to make the distribution somewhat closer to normal (Shapiro-Wilk  $p = 0.06$ ). Table 5.3 (below) summarizes these variables.

**Table 5.3 Dependent Variables Used in Analysis**

Variable	Obs	Mean	Std. Dev.	Min	Max
Forest Condition Change ('02-'07)	40	1.85	1.051251	1	5
Total Forestry Income	43	58950.6	113422.6	36.5	500000
Logged Per Capita Forestry Income	43	-0.94799	2.901251	6.03488	3.5998

## 5.9 Municipal Analysis Results

### 5.9.1 Forest Condition Change

Table 5.4 below shows the results of two models of the change in forest resource condition between 2002 and 2007. The models are the same, except that Model 2 includes community logging permits as well as an interaction term between community logging permits and the number of organizations involved in forestry; Model 1 excludes both of these.



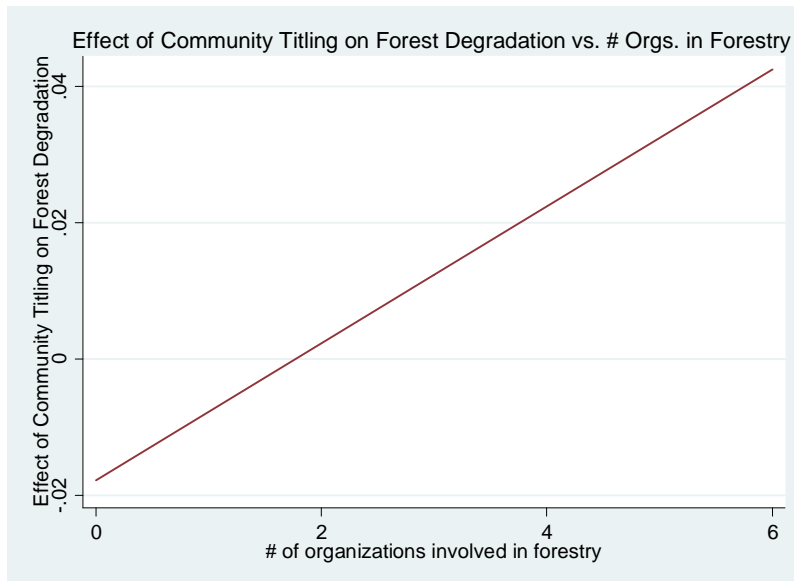
**Table 5.4 Multiple Regression Models for Change in Forest Condition (2002 – 2007)**

Variable	Model 1	Model 2
% county dedicated to agriculture	-0.03**	-0.03**
# organizations in forestry	-0.55*	-0.59*
% communities with titles	-0.02*	-0.02
% communities with titles * # organizations	0.01**	0.01*
% communities with permits	-	0
% communities with permits * # organizations	-	0
Intercept	4.878***	4.84***
N	38	37
Adjusted R <sup>2</sup>	0.37	0.32

Legend: \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001

Model 1 performs better overall (adjusted R<sup>2</sup> = 0.37, vs. 0.32 for Model 2). All of the independent variables in Model 1 were significant at the 0.05 at a minimum. In general, counties with more agriculture experienced less of an increase in forest degradation. On its own, having more organizations involved in forestry was also associated with less increase in forest degradation. However, the interaction reveals that in counties with more organizations involved in forestry, the estimated of titling on forest degradation actually *increases*, reversing sign about the mean value of the number of organizations in forestry. The obverse of this is that the estimated effect of more organizations on forest degradation changes between 2002 and 2007 also increases as more communities have titles. Figure 5.3 shows the relationship between the estimated effect of community titling on forest degradation and the number of organizations involved in forestry.

**Figure 5.3 – Effect of Community Titling on Forest Degradation vs. # Organizations in Forestry**



Community logging permits, another measure of *de jure* property rights, had no significant effect on forest condition change, nor was any interaction with the number of organizations present.

### 5.9.2 Income from Forestry

Table 5.5 shows the results of two multiple regression models estimating effects for logged per capita income from forestry at the county level.

**Table 5.5 Multiple Regression Models for Forestry Income**

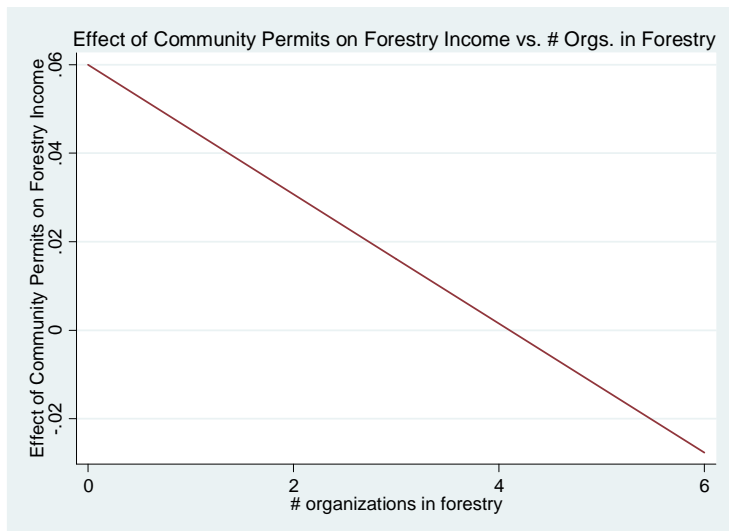
Variable	Model 1	Model 2
% county dedicated to agriculture	-0.07***	0.07***
# organizations in forestry	0.82**	0.7
% communities with permits	0.06***	0.06***
% communities with permits*# organizations	-0.01*	-0.02
% communities with titles		0
% communities with titles*# organizations		0
Intercept	-0.41	-0.42
N	40	39
Adjusted R <sup>2</sup>	0.51	0.5

Legend: \* p < 0.1; \*\* p < 0.05; \*\*\* p < 0.01

Model 1 performs marginally better than Model 2, (adjusted  $R^2 = 0.51$  vs. 0.5 for Model 2), and is also more parsimonious because it includes fewer variables; community titles, and the interaction between community titles and the number of organizations involved in forestry, are omitted from Model 1, and were furthermore not significant in Model 2.

Population-normalized incomes from forestry were lower in counties with more land dedicated to agriculture. In general, more organizations involved in forestry were associated with higher incomes from forestry. Likewise, forest incomes were higher when more communities had logging permits. The interaction term is also significant, and suggests that when there are more organizations involved in forestry, the positive association between community logging permits and forest incomes grows weaker, reversing sign when there are four organizations. Figure 5.4 shows this interaction graphically.

**Figure 5.4 – Effect of Community Permits on Forestry Incomes vs. # Organizations in Forestry**



The obverse of this is that when there are more communities with permits, the estimated effect of organizations on forestry income decreases, eventually reversing sign.

## 5.10 Discussion

The results of the municipal analysis are mixed, and raise a number of questions. While having more organizations involved in forestry appears to improve forest condition change outcomes, and is also associated with higher population-normalized forestry incomes, the analysis above does not provide evidence that institutional redundancy and polycentric governance enhance the *de facto* enforcement of *de jure* property rights.

### 5.10.1 Forest Condition Change

With respect to forest condition change, the number of organizations involved in forestry – a proxy for polycentric governance and institutional redundancy – did indeed moderate the effect of community titling on forest condition change. However, this moderation occurred in precisely the opposite direction of what would be expected if indeed *de facto* property rights are more effectively enforced with polycentric governance, and collective action can be more successful. There are a number of possible explanations for this result, and the cases of the Bolivian communities of Cururú and TIM Ivirgarzama are once again instructive.

First, it is possible that there are nonlinear relationships between the number of organizations, community titling, and forest outcomes. Additional analyses to test for parabolic relationships – either “U-shaped” or otherwise – did not, however, reveal such relationships.

Second, the institutions in Cururú that may have been principally responsible for facilitating the *de facto* enforcement of property rights for all community members were often local, and community-based. While the measure of “number of organizations” involved in forestry did include community organizations, it did not discriminate between just one community

organization and multiple community organizations. In particular, Cururú had multiple elected organizations that operate with separate but overlapping authority. Institutional data was not available at the county level for this resolution, and further studies should explore this possibility further. The literature provides some evidence that multiple local organizations – particularly, democratically elected local organizations – do indeed bolster institutional performance in the forest governance (Klooster 2000; Perez-Cirera and Lovett 2006). Engel (2006) found that NGOs may play a particularly pivotal mediating role in empowering communities to assert claims to forest resources. While NGOs were incorporated into the measure of multiple organizations involved in forest governance, separating it out as a binary variable did not reveal any effect – simple or interactive – on forest condition change. However, community-level data was once again not available in this data set, and it is likely that the existence of NGO activity at the county level does not reveal the degree to which they are actively involved with communities.

Third, it is possible that these results are genuinely reflective of upward moderation between institutional redundancy and forest degradation through *de jure* property rights. To the extent that elites capture benefits, having more institutions available to them may actually strengthen their hold on forest resources, and provide additional channels to capture benefits to the exclusion of sustainable resource management. The literature from Indonesia provides evidence of this occurring in Indonesia. McCarthy (2002) showed that illegal logging networks were created prior to forest decentralization in Indonesia, and they were not particularly weakened by decentralization. Rather, the elites that controlled the illegal logging networks continued to capture their benefits, and actually strengthened them by incorporating newly empowered local government officials into them. By paying off local officials, communities often remained

excluded from the benefits of timber extraction (Engel and Palmer 2008; Palmer 2001). The literature does not explicitly suggest that this is happening in Bolivia, but the possibility deserves consideration in future studies.

### **5.10.2 Incomes from Forestry**

With respect to livelihoods, as measured by incomes from forests, there is a key limitation in the data: the distribution of these benefits within counties is unknown. Thus, while higher incomes from forestry may be expected to generate benefits that are somewhat distributed among municipal populations, through the provision of wage labor and perhaps profit in the case of community-based forest management, it is also conceivable that higher incomes are associated with elite capture of benefits. The results show that community logging permits – a measure of *de jure* access and withdrawal rights – are actually associated with decreasing incomes from forestry (normalized to the population) as the number of organizations involved in forestry increases. Again, there are a number of possible explanations that deserve further study.

First, the actual value of forest resources at the county level in Bolivia is not well understood, and data on this was not available. The IFRI sites in Bolivia have been assessed for forest resource value, but there are far more forests in Bolivia than have been studied by IFRI. Thus, forest resource value is likely variable across the country. To the extent that more organizations are likely to be involved in forestry when resources are more valuable, the number of organizations may be endogenous in this model, and correlated with unobserved market conditions that also affect forestry incomes. If this is the case, then the parameter estimate for the simple effect of the number of organizations on forestry incomes may be biased, and the interaction term may in turn also be biased. On the other hand, there is evidence that institutional

formation is independent of market factors. Moreover, different counties have different levels of access to markets, and this is not easily captured by simple proxies such as distance to nearby cities. Most counties are seated relatively near to roads that connect the major cities of Bolivia. Still, the parts of counties that actually contain valuable forest resources can be variously close, or far away from, these roads. Both Cururú and TIM Ivirgarzama are in counties (Urubichá and Puerto Villarroel respectively) that are relatively near to the city of Santa Cruz – less than 4 hours driving. However, the forest of Cururú is itself rather remote, whereas the forest of TIM Ivirgarzama is less so. At the county level, however, both contain forests that are relatively near and relatively far from the important road. This level of resolution is lost when data is aggregated at the county level.

Second, reduced incomes from forestry may be associated with transaction costs that arise from multi-agency coordination. Alston and Andersson (2011) make the case that transactions costs associated with monitoring, reporting, and verification can compromise forest conservation initiatives. It is conceivable that where many organizations are involved in forestry, these costs reduce net incomes from forestry. Monitoring is costly, and the presence of multilevel state actors in forestry suggests that monitoring is taking place. In Cururú, the national government's primary responsibility was to ensure that the community was in fact doing what it said it was going to do with respect to forest management. The forestry superintendent collected reports from the management plan's coordinators, and approved them. Through this process, costs were incurred. In TIM Ivirgarzama, by contrast, logging is entirely off the grid, and no monitoring is necessary at all. Net incomes may be increased through this process.

Third, incomes from forestry may not necessarily reflect collective action success. For example, communities may log unsustainably when they are given legal and *de facto* rights to do so

(Klooster 2000). On the other hand, when communities do not have strong mechanisms to assert their claims to land, it may open the door for outside actors to legally extract timber, increasing the county-level incomes from forestry while simultaneously reflecting a lack of accountability and legitimacy. Thus, incomes from forestry may reflect a variety of processes, and may come from a variety of distinct sources. At the same time, they are a useful measure of the degree to which forestry activities are occurring, and are reported.

### **5.10.3 Community vs. Municipal Analysis**

Different forest system inputs, processes, and outcomes are observable at the community level compared to the county level. Under decentralization, much forest management occurs at community level, rather than at the county level. Therefore, analyzing forestry sector data at the county level necessarily involves aggregation data. In the process of aggregating data, some information is lost, but other data actually comes into sharper resolution. The networks that exist within communities, which are important proximate drivers of forest outcomes, are not visible at the county level. On the other hand, broader institutional patterns that involve multilevel state governance, as well as larger economic patterns – including the distribution of income across a larger number of households with a more representative mixture of livelihood strategies – become visible.

It should be noted that virtually all of the extant literature on the influence of polycentric governance on the local governance of natural resources studies municipal, regional, national, and even international governance loci. The comparative case study between Cururú and TIM Ivirgarzama, however, suggests that community-based organizations and institutions are also important. It is reasonable to expect that community-based organizations, by virtue of having a



far more direct connection to forest user groups than institutions that operate at larger scales, would promote *de facto* enforcement of *de jure* property rights differently. Studies on such institutions have been limited, although Klooster (2000) found evidence of community-level institutional redundancy conferring forest governance advantages in *ejidos* of southern Mexico.

The mixed results of this analysis speak to a need to include multiple levels of governance in such studies. Even though the county that contains Cururú – Urubichá – is itself relatively small county with roughly 6,000 inhabitants – data collected at this level still does not adequately capture many key activities of the community of Cururú, which has just a few hundred inhabitants. However, the community manages 26,000 of forested land, which represents roughly one quarter of municipal forestry activities, according to the president of AIMCU. Further robust studies of forestry institutions should therefore consider (1) the relationships between state and non-state organizations and communities that are engaged in forestry, and (2) redundancies among community-based institutions themselves.

## **Chapter 6 - Conclusion**

This dissertation used quantitative and qualitative methods to shed light on the institutional determinants of forest governance outcomes in the Bolivian lowlands. From the results of the analysis, I advance the argument that the local governance of forest resources is strongly influenced by network-based inequality, which is based on other forms of heterogeneity and inequality, and can also be mediated by institutions at a variety of scales.

Answers to the questions that are treated in this study are important for the millions of people that live in and depend on tropical forests, and also to other actors including governments,

NGOs, foundations, private sector actors interested in conservation investments, international organizations, and members of the public who are concerned about tropical deforestation and forest degradation. To conclude this investigation, I discuss the findings from the empirical in terms of their implications for forest policy and further study.

## 6.1 Policy Implications

Tropical forests are important for our collective welfare. By removing carbon from the atmosphere, they help to mitigate climate change caused by rapid growth and its adverse effects. Whereas the temperate forests of the developed world are regulated and protected by laws that are well specified and enforced, the tropical forests of the developing world do not always enjoy such protections; even when laws exist to protect forests, they are not always enforced. Moreover, the laws that do exist and are enforced are not always effective, efficient, and equitable.

While this study, like the literature that it builds upon, does not suggest any panaceas that policy makers can implement, I argue that it suggests several principles that should be considered as policy heuristics.

- 1) Where economic inequality is high, and forest communities do not have *de jure* rights to their forests, conservation initiatives are less likely to succeed.
- 2) More heterogeneous communities may have more network-based inequality than more homogeneous communities.
- 3) Local institutions appear to mediate network-based inequality, although the complex nature of this mediation remains poorly understood.

Motivated largely, but not exclusively, by concerns about climate change and the importance of tropical forests for mitigation, there have been growing efforts by the international community to reduce deforestation and forest degradation. The most important international framework for these activities is REDD+, or Reducing Emissions from Deforestation and Forest Degradation in Developing Countries +Enhancing Forest Carbon Stocks. REDD+ was initially conceived of as a system to support PES (Payments for Environmental Services) schemes around the world using money from wealthy countries and carbon buyers. Since then, due to a variety of factors including the collapse of international climate talks in Copenhagen in 2009, and the continued elusiveness of a robust international carbon market, the focus has broadened to non-PES forest conservation schemes including strengthening protected areas, supporting community-based and joint participatory forest management programs, and more recently reforestation (Angelsen et al. 2012). Forest governance questions – including where investments in conservation schemes are likely to succeed – are central to national governments, international actors, and donors who are supporting REDD+ projects.

Since its beginnings at the Bali road map of 2007, hundreds of small and first generation REDD+ projects have been started in tropical forests around the world. While no such projects exist in Bolivia, they have been implemented in its neighbors, Peru and Brazil (GCP 2011; Sills et al. 2009). These projects have demonstrated the importance of tenure security and titling, and a consensus has emerged that *de facto* enforcement of *de jure* property rights is necessary for REDD+ projects to succeed (Duchelle et al. 2013; Sunderlin et al. 2013). Moreover, the generation of social and environmental co-benefits, including a suite of non-carbon related environmental services and livelihood benefits is thought to vary with tenure security (Larson 2011; Angelsen 2009).

As REDD+ projects - which themselves encompass a variety of strategies including jurisdictional reform and payments for environmental services – continue in their deployment, policy makers at international, national, and sub-national levels must carefully consider how local tenure conditions and networks are likely to mediate forest conservation efforts. Currently, the selection of project sites is largely based on perceived deforestation pressure, forest cover, available information on *de jure* property rights, and the amenability of authorities (Cenamo et al. 2009; May et al. 2011). The findings in this study suggest that titling is indeed important, and the presence of formal legal titles in forest communities is an important factor in shaping forest governance outcomes. However, titling does not necessarily or automatically produce desired outcomes – it must not only be done, but it must be done well. Doing it well entails considering group cohesion and history, and the degree to which communities have their own *de facto* institutions and organizations that are capable of enforcing property rights that are specified through *de jure* processes. It also involves assessing what types of inequality exist locally. Are there networks of elites that are capable of capturing benefits, or even utilizing new venues created by formal titling processes to further fortify their control of benefits that flow from natural resources? If so, what safeguards can be implemented to ensure that collective titles, for example, are effectively enforced for all legal rights holders? It is essential that decision makers in all sectors and at all level consider these questions when formulating strategies for REDD+ and other forest conservation initiatives.

I argue that these important considerations for site selection should be augmented with local preliminary data collection on community-level heterogeneity, inequality, and institutions. Not only should the degree to which such local conditions are likely to produce desirable outcomes be considered, but they should also be monitored as REDD+ projects progress. Inequality and

heterogeneity, while treated largely as inputs in the theoretical framework of this dissertation, are also themselves outcomes of interest. Tenure security – especially *de facto* enforcement in cases where *de jure* property rights already exist – is also an important potential co-benefit to REDD+ (Larson 2011; Sunderlin et al. 2013) and should be monitored carefully at the community level. REDD+ presents an important challenge to the status quo, and if the incentives are created effectively, tenure security for forest peoples may be increased by its effective implementation (Larson et al. 2013). On the other hand, poor implementation of REDD+ that does not pay careful attention to local conditions might threaten to recentralize forest governance, and even exacerbate land-based inequality and tenure insecurity (Phelps et al. 2010).

The last analysis in this dissertation suggests that institutional redundancy, along with polycentric and multilevel governance, may affect the success of forest governance. Given these mixed results, policy makers should pay particular attention to the qualitative nature of multilevel governance and the structure of organizations that are involved in forest governance. There is evidence that organizations with overlapping roles at the municipal, regional, and national levels can bolster institutional stability and improve forest governance outcomes, particularly with respect to equity (Andersson and Ostrom 2008; Ostrom 2010; Lubell et al. 2002). On the other hand, there is evidence that the presence of multiple overlapping organizations present an opportunity for elites to capture institutions more completely, exacerbating forest degradation and threatening local peoples' livelihoods even further (McCarthy 2002; Engel and Palmer 2008; Forsyth 2002).

In all likelihood, there are multiple factors that conspire to determine which of these outcomes ultimately occurs. These factors are myriad, and while it is beyond the scope of this dissertation (and the capabilities of the data that is available to me) to assess their significance, the literature

and this investigation suggest that policy makers should at least qualitatively consider the following themes when designing forest conservation policies (whether or not they are linked to REDD+) or deploying forestry interventions:

1. Downward accountability of organizations involved in forestry to forest peoples – for example, are there mechanisms to ensure that local peoples’ concerns are reflected in forest management planning?
2. Relationships between multiple levels of governance – for example, are central government regulations enforced at the regional and local levels?
3. The level at which most organizations are active – for example, does the regional or local government have a disproportionate number of organizations with decision making authority involved in forest governance?
4. The nature of community-level organizations – for example, do local communities have an elected body with meaningful decision making authority? Are there multiple such organizations per community?
5. The strength of local networks of elites and powerful actors – for example, is there one kinship or ethnic group that monopolizes power and captures benefits?

This is by no means an exhaustive list of items that policy makers should consider when selecting sites and designing strategies for forestry interventions including REDD+ projects.

Nevertheless, considering these questions will nonetheless provide basis for critical analysis of local conditions and institutions as they pertain to forest governance, and can help policy makers to identify better areas and strategies for interventions.

## **6.2 Further Study**

This study has produced the following three central findings:

- 1) Bolivian municipal data suggests that economic inequality is, other things being equal, associated with worse forest condition and livelihood outcomes, but that this association is weakened by the presence of formal community land titles
- 2) Even when formal titles exist, multiple types of inequality and heterogeneity can conspire to produce network-based inequality at the local level. Extreme network-based inequality is a proximate driver of undesirable forest condition, likelihood, and equity outcomes.
- 3) The adverse effects of network-based inequality can be mediated by good institutional design, though a precise recipe for optimal institutions remains elusive. The presence of multiple elected bodies at the local level emerges as a candidate for a good heuristic measure, and invites further examination.

The findings overall suggest that issuing titles and permits to communities can be important and useful if it is done well. Doing it well, however, requires good institutional design, and a robust understanding of local networks of actors. Further study on the role of these networks in a variety of national and sub-national contexts, along with the types of institutions that are capable of effectively mediating the effects of network-based inequality would therefore be very useful.

### **6.2.1 Generalizability**

Given that the data for this study was collected in the Bolivian lowlands, one cannot assume that these findings can be extrapolated to all other contexts. Because it is problematic to generalize findings from a study of this type, it is important that the hypotheses tested in this study be tested in other contexts. The results of studies of the local governance of natural resources around the

world have been mixed in part due to diffuse methodologies and different scholars prioritizing different variables. However, the mixed results also have to do with genuine differences among coupled natural-human forest systems of the world. Some of these differences are easily characterized. Demographic, socioeconomic, biophysical, and institutional data can be collected and compared across sites; the data collected by IFRI over the past decades is a testament to this possibility. On the other hand, the complexity of these systems, with transactions and interactions among the many important variables and groups of variables, render generalization especially difficult. In this sense, there are latent and effectively unobservable differences between the human-forest social-ecological systems of the world, which make it particularly important to repeat studies in a variety of contexts.

Municipal data – or data from the equivalent level of governance - from other tropical countries already exists in some capacities, and should be combined with survey data to test the degree to which community titling moderates the effect of economic inequality on forest outcomes in a variety of contexts. Community-level studies should also be conducted to better understand the mechanism by which titling does moderate the adverse effects of economic inequality. For example, is the primary mechanism that titling permits forest communities to exclude outside actors and reduce illegal logging? Or does it increase tenure security and incentivize the development of sustainable management plans? Alternatively, is there some other interactive effect that occurs at the local level? In any event, what conditions are necessary to maximize the effectiveness of titling, and bolstering the *de facto* enforcement of the *de jure* property rights that it confers?

### **6.2.2 Multilevel & Polycentric Governance and Institutions**



The comparative case study analysis in Chapter 5 suggested the hypothesis that having multiple organizations involved in forestry creates redundancy through polycentric governance that fosters better forest outcomes through stronger institutions. While the qualitative analysis suggested that this was the case in Cururú, the municipal analysis did not find evidence for this effect. One further hypothesis that emerges is that community level institutions – by virtue of being subject to more downward accountability – are different from municipal and higher level organizations in several respects. For example they may (1) be more resistant to capture by elites, (2) encourage local people to develop organized strategies for sustainable and lucrative forest management, or (3) provide direct checks against outside organizations with interests that run counter to those of local people.

Testing these hypotheses with a rigorous methodology and in multiple contexts will lead to an improved understanding of how community institutions can improve forest governance, and the findings of such studies can inform policy makers, NGOs, and communities themselves in designing effective interventions.

Another set of questions that emerges from the analysis in Chapter 5 concerns the *type* of interactions between organizations that are involved in forest governance. In Cururú, there are actors from the community, the county, NGOs, the regional government, and the central government all involved in forest governance. By contrast, in TIM Ivirgarzama, fewer levels and loci of forest governance operate. Even allowing for the limitation that the municipal analysis did not take into account community-level institutions, it still did not find a link between having *more* levels and loci of governance and stronger enforcement of *de jure* property rights, as was predicted. In fact, the opposite appeared to be true. This suggests an important question – does

the presence of more levels and loci of forest governance strengthen or weaken institutional performance? And by what mechanism does it do so?

Answering these questions will provide a more complete understanding of the institutional dynamics of coupled natural-human systems in the tropics, and further empower decision makers to design critical policies that may ultimately affect the lives of the many people who live on and depend on forests, as well as the course of international climate policy.

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