Chapter 2

Challenges and opportunities for communal forest management in South America

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1. Introduction

This chapter analyzes the principal factors that influence the successes and failures of communally managed forest resources in a range of South American contexts. It reviews and summarizes the findings of the growing body of literature that deals with this issue and then examines the findings in the context of case studies from five South American countries.

Most scholars who study the institutional arrangements for natural resource governance agree that forests should be considered as common-pool resources (CPRs) since they are neither public nor private goods, but share elements of both. This characteristic means that forests are particularly vulnerable to degradation and overexploitation because it is difficult to exclude people from them, leading to overconsumption (that is, they are 'subtractable' resources, see Section 2 below). In order to avoid such negative outcomes, and in order to manage forests sustainably, we argue that communities who manage forests need institutions. These are defined in this study as sets of agreed-upon rules that are followed by most community members and which control access to and regulate competition over forest resources (Winter 1998; Ostrom *et al*. 2002).

Section 2 of this chapter is devoted to understanding forests as CPRs by describing and discussing the main problems that local forest-user groups face in managing their forests. This section also reviews the literature on the principal factors, attributes and indicators that relate to the effectiveness of communal forest management, summarized as attributes either of the resource or of the resource user. Our discussion relies principally on research by Ostrom (1998), Gibson *et al.* (2000), and Agrawal (2001) that summarizes the challenges to community management of forests. These challenges result from particular attributes of the resource, in this case the forest, and of the users.

Section 3 provides a historical overview of some specific features of communal forest management in South America. When compared to formal community forestry groups in developing regions of East Africa and South Asia, South American forest-user groups have access to relatively valuable forest resources. While formal governmental legislation to enable community forestry is fairly recent in South America, the challenge for rural communities to govern their forests is not new. As a consequence, we predict that local institutions in South America will successfully mitigate the effects of exogenous factors such as national policies and market forces.

Section 4 of this chapter presents three short case studies that highlight how some rural communities have modified local institutions to deal with or to take advantage of new governmental regulations and market opportunities in the forestry sector. Case 1 comes from Bolivia where laws required indigenous Yuracaré communities to document their historical use of land before they could secure forest ownership. The Yuracaré also had to develop a forest management plan approved by the forestry service before they could harvest trees – even from their own land. Working with an International Forestry

Resources and Institutions (IFRI) team that included social scientists and foresters, the community was able to document its history and develop forest plans to gain these rights. As a consequence, the traditional subsistence uses of the forest were expanded to include harvesting for the market, and the Yuracaré had to develop new local institutions to deal with the new market opportunities (Becker and Leon 2000).

Case 2 comes from Mexico. Here, a Zapotec indigenous group possessed local institutions for managing forests for subsistence but reorganized them to take advantage of new rights to market timber with the Mexican government. To date, the community has developed forest management plans and received a new forestry certification from the SmartWood programme of the Forest Stewardship Council, an international nongovernmental organization (NGO) created to promote responsible forest management worldwide.

Case 3 comes from Honduras where new laws have moved legal ownership of large areas of the forests from the national government to municipalities. However, local people found this did not solve many of their problems, so they have organized cooperatives and federations of cooperatives to develop the power to negotiate better contracts, access and marketing.

A descriptive analysis of IFRI data about the main characteristics of forests in South America is presented in Section 5 in order to shed light on the opportunities and challenges that local forest-user groups face there. In this section, we also introduce our expectation that we will find healthier forest at sites where user groups have reached more cohesive levels of organization in their collective activities.

Also within this section, descriptive statistics and a simple cross-tab analysis are used to examine empirical data on attributes and characteristics of the settlements or villages, the forest-user groups and the forests themselves. Researchers in the IFRI research programme collected this information, visiting 34 sites in Bolivia, Ecuador, Guatemala, Honduras and Mexico between 1994 and 2002. Information from each of these sites was collected following the same research protocol and methods, making the data comparable.

The descriptive statistics generated from these sites illustrate the variety of local conditions that exist in our sample. The cross-tab analysis assesses the relationship of the local institutions with the forest conditions for each of the sites by testing whether there is a statistically significant association between highly organized collective activities and relatively good forest conditions. Our results indicate that the stronger the local institutions for harvesting and monitoring the better the forest conditions, but we cannot conclude that strong local institutions are sufficient to solve every kind of collective dilemma.

2. The nature of forest goods

As human populations and their demands on forest resources grow, citizens and officials from around the world search for solutions to the problems of forest degradation and deforestation. Many factors contribute to make forests very challenging to govern effectively. Most of these challenges emerge from the biophysical characteristics of forest resources.

Policy scholars classify resources as public or private goods based upon two dimensions: (i) the ease with which potential outside users can be excluded from access to the resource = the ‘excludability’ of the good, and (ii) whether or not a good once consumed is available for others to consume = the ‘consumption’ of a good (Ostrom and Ostrom 1999). Consumption can be either subtractive or joint: the former being a good that once consumed by one household is not available to another household (e.g., a tree), and the latter depicting a situation in which a household can enjoy the benefit of a good without subtracting from the amount available to another household (e.g., clean air; Varughese 1999).

Therefore, goods vary in their underlying attributes. Goods that are nonexcludable and subject to rivalry, like fish in the ocean, are called CPRs. Public goods such as a stable climate are nonexcludable and nonsubtractable and benefit all human beings; while private

Table 1. Grouping of forest products based on two series of attributes. Source: Adapted from Varughese (1999).

Exclusion		Consumption: Subtractive	Consumption: Joint
	Difficult	*Common-pool resources* Fodder, wood, herbs, fruits, water	*Public* Habitat for plant and animal species, local climate, watershed protection, carbon sequestration, reservoirs of biodiversity
	Easy	*Private* Fodder, wood, herbs, fruits, water	*Toll goods* Areas or products of religious significance

goods are both excludable and subtractable. Toll goods, such as toll roads, are excludable but nonsubtractable. Table 1 illustrates the complexity of forest resources by summarizing their different biophysical attributes.

The definition of common property varies among scholars. However, most definitions of common property rights include these elements: (i) a well-defined group of co-owners, who (ii) develop and adhere to a well-defined management regime, that includes (iii) proscribed access by owners and exclusion of nonowners, and (iv) rights and duties of owners with regards to rates of use of the common property resource (Feeny *et al.* 1990; Swaney 1990; Bromley 1991).

CPRs are all subtractable in their natural environment with poor excludability, and include resources such as fodder, wood, herbs, fruits and water. But once subtracted by a household they are converted into private goods and are therefore easily excludable. Public goods such as clean air and water can be consumed not only by the households sharing the forests but also by other people outside the forest. However, forests can also be referred to as toll goods if there are sacred areas where only selected persons are authorized to go, therefore excluding all other households by internal rules of the forest-user groups.

Market mechanisms are thought to be the best governance institutions for private and toll goods, especially because of their characteristic of easy excludability. Because of their nonsubtractability, public goods are generally thought to be best managed within the purview of government. CPRs, on the other hand, combine problematic aspects of both dimensions. Since they are subtractable like private goods, they can be overused or even destroyed, but since it can be costly to control access to them (= excludability), it can be difficult to restrict the rate at which they are consumed. Most natural resources that everyone cares about are common-pool goods. Examples include forest products, water for irrigation, and fisheries. Their effective management remains one of the most difficult tasks facing modern public policy. Most forest ecosystems share the principal characteristics of CPRs and, as such, they pose different and arguably more difficult challenges to governance than do smaller-scale resources, whether these be private or public.

Another complication in the use of forest resources is that certain types of forest use can produce significant secondary or external effects (= externalities). For example, harvesting trees on a hillside may alter the local species composition, the carbon uptake capacity of a larger forest ecosystem or, through silting, the quality of nearby streams and lakes. As a consequence, the effective governance of forest resources must take a broader view of management-related externalities in order to avoid negative effects.

Finally, the spatial and temporal nature of forests and their potential externalities often do not correspond with existing political jurisdictions. Forest borders are rarely equivalent

to political boundaries, giving local managers only a partial understanding of the total forest resource. It often takes decades before degraded forests can regenerate, and it can take just as long to understand the true impact of forestry policies. However, political institutions generally encourage officials to operate within shorter time frames. Thus, it is not uncommon for policy-makers to ignore some of the more serious forest-related problems.

In summary, forests exhibit many characteristics that defy simple policy solutions. CPRs, where the exclusion of potential users is difficult, can present management challenges to policy-makers and those that enforce policy. Forests possess important externalities with regard to atmospheric, hydrological and biological services, many of which are hard to quantify and control. Forests are also complex in the sense that they can generate a myriad of products such as wood for construction or fuel, wildlife that is trapped or hunted, and leaves, fruits, fodder, seeds, straw, shade, recreation, stones and fertile soil, along with scores of other products consumed by humans. All of these products can mature at different rates, may be managed using both consumptive and nonconsumptive approaches, and can possess characteristics of common-pool, private or public goods, all the while providing ecosystem services for localities, regions or countries.

2.1 The characteristics of common property forests

One of the most common sources of confusion about the management of CPRs is how to distinguish their characteristics from their associated property rights regime. Part of the confusion is likely to stem from the terminology itself. For instance, rights to a CPR such as a forest can belong to the general public (= state property), to a government (= governmental property), a private individual (= individual private property), or a group of individuals (= group-owned private property). Likewise, "when they are owned by no-one or paradoxically by 'everyone', they are used as open-access resources by whoever can gain access" (Ostrom 2003).

McKean (2000) shows that individual private property rights often do not provide the best basis for effective forest management. Her argument is that privatization of forests often leads to forest fragmentation, which may seriously disturb the proper functioning of the forest ecosystem. Because of these drawbacks, she suggests that forests are better suited for management under common property regimes in which larger chunks of contiguous forest have a higher probability of being maintained. Such systems also tend to be more efficient to administer.

The governance of forests as common property may have many advantages over treating them as individual private property, but that is not to say that it is free from its own problems. Forest users may have conflicting interests and goals with regards to their forest use. Furthermore, individuals within the same forest-user group may have different levels of knowledge about the resource and different access to information, economic resources and political power. These asymmetries complicate the individuals' efforts to achieve successful joint outcomes, i.e., the way in which they should manage their collectively owned forest. Social scientists have given considerable attention to the problems that challenge the governance of forests as common property. The next section reviews the main findings of this vein of social science research.

2.2 Challenges in governing forests as common property

Collective-action problems "occur when individuals, as part of a group, select strategies generating outcomes that are suboptimal from the perspective of the group" (Ostrom and Walker 1997). These problems are caused by a lack of information, difficulties in coordination, the existence of obstacles to exclusion and rivalry of extraction (Poteete and Ostrom 2002). This leads to information asymmetries, and motivational problems then arise (Ostrom *et al*. 1993). Any or all of these can lead to the deterioration of a community's forest(s). Some communities are able to overcome such problems by developing highly organized institutions to deal with them, while others are not.

Using a range of field observations, Ostrom (1990) showed that it is possible for local communities to self-organize in ways that resolve complex collective-action problems related to natural resource governance. In fact, local communities have often demonstrated that their self-organized efforts in natural resource management can outperform government programmes (McCay and Acheson 1990; Ostrom 1990; Feeny *et al*. 1998).

Nevertheless, institutions that effectively manage forests do not have to be self-organized, as it is possible for positive collective outcomes to occur through government coercion. This was the accepted approach to forest management as recently as 30 years ago in several areas of the world (Arnold 1992, 1998; Wunsch and Olowu 1995). The policies that flowed from coercive control emphasized the 'scientific' exploitation of forests within a context of economic return (Richards and Tucker 1988; Scott 1998). We now know that such an approach can be ineffective in forest management, not only because of the costs involved, but because local communities will often simply not buy into the centralized state programme. In regions of resource scarcity, where forest products are essential for local livelihoods or where forests are isolated, state-controlled agents are commonly unable to secure, manage or protect the forests. Such a top-down strategy can also generate undesirable side-effects, for example, policies may not be flexible enough to cope with local ecological variation or local people's needs, knowledge and preferences.

Significant shifts in accepted forest governance standards have occurred in the last 30 years or so. One of the major changes has been to confer property rights over forests to local communities. Based on the idea that local communities live with forests, are primary users of forest products, and often create *de facto* rules that significantly affect forest conditions, scholars and policy-makers argue that more equitable and effective outcomes can frequently (though not always) be reached by transferring *de jure* rights over forests to local communities (Perry and Dixon 1986; Arnold 1990; Bhatt 1990; Dei 1992; Douglass 1992; Ghai 1993; Raju *et al*. 1993; Ascher 1995; Clugston and Rogers 1995; for reviews, see Wiesner 1990; Baland and Platteau 1996). The core theory is that local users hold important time- and place-specific knowledge necessary for the creation of successful forest management, particularly for the institutional arrangements that are needed to achieve success (McCay and Acheson 1987; Berkes 1989; Ostrom 1990, 1992a; Bromley *et al*. 1992; McKean 1992; Peters 1994; Wade 1994).

With community management of forests now receiving increased attention from policy-makers, an empirical literature is developing that addresses the causes of success and failure for community-based natural resource management. In her 1999 paper, Ostrom suggests that although the necessary conditions for effective communal forest management vary across contexts and countries, there are some that are basic to good local governance. These conditions can be grouped into two sets of variables: the attributes of the resource and the attributes of the users, as described in Box 1 (overleaf).

If users have the attributes listed in Box 1, they are more likely to be willing to invest time and effort in the management of their forest resources, unless the resources are perceived to be threatened in some way and competition for them has become acute. A positive trade-off between costs and benefits must exist in order to achieve effective communal forest governance. Provided there is sufficient information available, forests in good condition with enough available products will give individuals more choice. Under these conditions, individuals are more likely to develop practices that can produce and sustain a self-organized system of forest management.

The resource attributes described in Box 1 help to define scenarios where organizing for communal management pays off. However, this will only be the case if the forest-related products generate significant monetary or subsistence income for local populations, and possible sources of conflict are minimized so that agreements can be made based on trust. Among the attributes of the forest, size is a particularly important determinant of the success of communal forest management. Another important contextual factor is the autonomy that allows forest-using individuals to craft forest management rules themselves and to implement them.

Box 1. The conditions for successful communal forest management

Attributes of the resource

Improvement potential
The resource is not either so degraded or so underutilized that attempts to organize it are pointless.

Indicators
Reliable and valid information about the state of the resource is available at a reasonable cost.

Predictability
It is relatively easy to predict the supply of forest products.

Spatial extent
The resource is small enough so that users, given the transportation and communication technology available, can understand its microenvironments and know where its boundaries are.

Attributes of the users

Salience
Users are dependent on the resource for a major portion of their livelihood or subsistence.

Common understanding
Users have a shared understanding of the resource and of how their actions affect it and each other.

Discount rate
Users set a sufficiently high value on the future benefits to be derived from the forest resource to make community management appear attractive.

Distribution of interests
Users are equally affected by coordinated management of the resource, irrespective of power or wealth.

Trust
Users trust each other to keep promises and to form mutually beneficial relationships.

Autonomy
Users are able to determine access and harvesting rules without external authorities countermanding them.

Prior organizational experience
Users have learned at least minimal organizational skills through participation in other local associations or from neighbouring groups.

Source: Ostrom 1999.

While this list is by no means an attempt to exhaust all possible determinants that shape self-organized management of common property forests, it does provide a comprehensive account of some of the more influential and relevant ones. However, one should keep in mind that, for any given situation, this set will depend upon the environmental and socioeconomic contexts.

3. Communal forest management in South America

This section provides a brief historical overview of some of the features of communal forest management that are particular to South America. Compared with other developing regions, including East and West Africa and South Asia (Agrawal and Ribot 2000), South American forest-user groups have access to relatively valuable forest resources. While the legislation to enable community forestry in South America is fairly recent, the challenge for rural communities to govern their forests is not new. Historically, community forestry activities have been important to the livelihoods of most rural people in South America, even though formal state governments have not always been supportive of such activities.

Most of the independent South American republics gained their freedom during the 19th century. Since then, these newly created countries have continued to follow the old colonial rulers' policies of confiscating large land areas from indigenous people, allowing them to keep only small areas of forestlands in comparison to what they originally possessed. Beginning in the 1950s, many developing countries nationalized such natural resources as land and forests to improve forest management. These areas were converted to *de jure* government-property regimes, eventually to become *de facto* open-access regimes (Arnold 1998). Governments divided forested CPRs into individual tracts, and in due course these lands were then distributed as private property to members of the ruling elite, and not as government concessions as had been the colonial tradition. While such 'reforms' improved the security of forest owners' tenures, they also had several undesirable socioeconomic consequences, such as skewed distribution of forest property rights. These privatization reforms offered lucrative opportunities for the richer members of society, while poorer groups lost access to the resources on which their livelihoods depended.

By the mid-20th century, most South American countries had ongoing government programmes promoting mass colonization of both previously undisturbed tropical forests and forests inhabited by indigenous populations. Policies like these formed integral parts of governmental strategies to relieve pressure on increasingly scarce agricultural lands in more heavily populated regions and to stimulate growth of export-oriented agricultural economies.

Thus, even by as late as the mid-20th century, conservation of forest resources was not an issue for the South American governments, nor were they concerned with the customary rights of indigenous peoples. Typical government policies and practices continued to remove indigenous populations from their lands or severely reduce the geographical extent of traditional lands. Policies were aimed at improving the operating and ownership conditions of large-scale, private agricultural and timber entrepreneurs, although uneven implementation of policies led to situations where forests might either be publicly owned by the nation-state, *de facto* owned by private citizens, granted to private citizens under formal private property rights transfers, or remain open-access resources. A national policy bias towards agriculture, along with land-use conflicts among users with overlapping claims, produced a high level of forest tenure insecurity. As a result, rather than stimulating the investment of time and money to produce longer-term management systems and sustainable yields, maximization of short-term profits dominated the logic of forest management practices in the region (Pacheco 1999; Contreras and Vargas 2001; Andersson 2002).

Despite the fact that most South American countries have at one time or another reformed land and forest legislation in favour of private rights, various forms of collective access to natural resources have persisted. These are exemplified by community institutions in Bolivia, Ecuador, and Peru, 'ejidos' in Mexico and Guatemala, and indigenous territories in Bolivia and Colombia. Therefore, most of the recent legislative changes at the constitutional level have had no practical implications for many local people who were already managing the resources as if they owned them.

By the end of the 20th century, most South American countries had introduced a new set of policies that aimed to encourage conservation of the environment and to restore

indigenous groups' rights to land. The change in some countries is occurring through a two-fold process whereby NGOs, which can be local, regional or international, help indigenous groups to articulate their demands, while central government organize the top-down transference of rights (Hernáiz and Pacheco 2001; Urioste and Pacheco 2001).

Today, the national governments of most South American countries publicly acknowledge the importance of local institutions in sustainable natural resource management, although much of this has yet to be implemented. While some recent policies have supported *de jure* rights of previously ignored local forest-user groups and of local (municipal) governments, it is only now that they are beginning to translate into real empowerment of community-level institutions in forestry sector governance. Interestingly, recent studies in Bolivia, Colombia and Guatemala have shown that those newly empowered municipal governments that emphasize collaboration with a variety of governmental and nongovernmental actors, including local forest-user groups, perform far better in supporting forest tenure security than municipalities that follow a classical top-down governance scheme (Gibson and Lehoucq 2003; Andersson 2004).

4. Opportunities and challenges of community forestry

In this section, we introduce the opportunities and challenges that local forest-user groups face in managing their forests in South America. We begin by presenting three community forestry case studies from Bolivia, Mexico (from Tucker *et al*. 1999) and Honduras to illustrate how communities can organize their forest use in order to take advantage of newly occurring opportunities.

The case studies are analyzed on the premise that the performance of local institutions is crucial not only to successful communal management of forests but to sustainable forestry practices in general. We then further examine our hypothesis in relation to data that were collected during fieldwork by IFRI's Collaborative Research Centers (CRCs) in Bolivia, Ecuador, Guatemala, Honduras, and Mexico between 1994 and 2002. We include a set of attributes and characteristics from 34 settlements and 47 forest-user groups who have access to forest areas of variable size. These were selected to reflect the heterogeneity of the South American region in terms of rural communities' relationships with forests.

A forest-user group is defined as the people who share the same rights and duties to products from the forest(s) (e.g., a group might be devoted to timber harvesting, gathering of medicinal plants or fruits, and hunting), even though they may or may not be formally organized. A settlement refers to a local jurisdiction inhabited by one or more forest-user groups. It could also be referred to as either a community or a rural village. There is not a one-to-one relationship between the number of settlements and forests, since a settlement can encompass more than one forest; therefore the number of forests can be larger than the settlements, as in this study.

Case 1 – Forestry management in the Yuracaré territory, Bolivia

The Yuracaré are one of Bolivia's indigenous groups. In the past, the Yuracaré have been quite mobile within large territories, but during the 19th century they settled within the Chapare River watershed. This territory is now home to 11 Yuracaré extended families, each composed of 11 to 20 nuclear families. According to the 2001 census, the population of the entire group was then 2358 people.

During the last 20 years, Bolivian forestry regulations have created conditions under which indigenous groups can commercially exploit the forest. As a result, the Yuracaré have become motivated to organize local forestry associations for commercial timber exploitation, and they have adapted their social organization and forest management practices to the scope of the regulations. Like the other indigenous societies that live in Bolivia's lowlands, the Yuracaré traditionally rely on self-governing institutions to manage their natural resources.

By 1992, the Yuracaré had created a forestry association and had received an annual permit from the national forestry agency (CDF, Centre for the Development of Forestry), authorizing a regulated timber harvest. Within the association, each Yuracaré negotiated the amount of timber to be harvested individually according to their own experience and needs. This practice reinforced each Yuracaré's knowledge of the territory as a whole, and did not compromise the ecological conditions of the forests. There were no technical rules for cutting trees in terms of size, rather the Yuracaré developed their own system of forest classification, and harvesting occurred in relation to maturity. The Yuracaré harvest rotated within their territory, not because of a lack of resources but owing to their perception of 'using without depleting'. Normative social behaviour was an important mechanism that controlled the relationship between forest use, harvest and ecological conditions, and this permitted the Yuracaré to secure both forest and societal sustainability over time.

In 1996, new land regulations in Bolivia transferred ownership of nearly 20% of the country's lowlands (20 million ha) to about 30 indigenous groups in the form of common property. The Bolivian lowlands encompass roughly 70% of the country, and approximately 80% of Bolivian forests are found there. The territories of the indigenous groups were recognized along with rights of customary ownership of renewable resources and governance. In 2000, the Yuracaré were given title to 240 000 hectares.

This new regulation launched a process that reinforced the Yuracaré forest management system within a timber production paradigm, but it also required greater regulatory detail such as the formulation of a Forest Management Plan for the collective management of the forests. Since timber production was traditionally an individual undertaking, the Yuracaré were now required to develop new institutions to deal with the opportunities of the new legislation. They began a process of learning through experiencing. The Yuracaré are currently facing some important challenges such as how to bring together collective and individual management, how to harmonize collective and technical decisions, and how to arrange joint forest management contracts with business enterprises without losing institutional capacity.

Today, the Yuracaré control the entire Chapare River watershed, practising farming, hunting, fishing and gathering of forest resources, mainly within a context of household self-consumption. The population is strongly dependent on the forest as the main source of food for its survival. Activities include itinerant seasonal agriculture, hunting, fruit and seed collecting for food and medicine, and harvesting of both construction materials for dwellings and timber products for the marketplace. Part of their economy is based on forest products and is thus subject to internal and external market dynamics (Becker and Leon 2000).

Case 2 – Forest management in Capulálpam, Oaxaca, Mexico

It is estimated that as much as 80% of Mexico's forests can be divided into two common property categories, 'ejidos' and indigenous community lands. The 'ejido' is a traditional management system for land and natural resources dating from precolonial times that establishes common property rights for small-scale landholders and individuals with usufruct. Each 'ejido' encompasses a number of landholder households. Both 'ejidos' and indigenous community lands are governed and used by those who have rights under customary rules, hence self-organization is known in this part of the world.

The municipality of Capulálpam de Méndez (Capulálpam) is a Zapotec-speaking indigenous community in the State of Oaxaca, Mexico. Capulálpam is located in the Sierra Norte to the northeast of Oaxaca de Juarez. It has a complex topography: the municipality is composed of 315 families whose dwellings are dispersed across a sloping pine–oak forest landscape and surrounded by agricultural fields. Community inhabitants practise many long-standing Zapotec traditions.

In the 1960s, a conflict arose between the indigenous community and the state government which had granted a large timber company a forest concession. Because the inhabitants of Capulálpam were not benefiting from this commercial arrangement, they organized a major protest, claiming rights to the forest concession. The campaign was

successful and, in the 1980s, what has started as a protest movement became UZACHI, a Zapoteco–Chinanteca union that encompasses people from these indigenous Mexican societies, with duties to plan and monitor the management and use of the forests.

Today, the community enjoys exclusive ownership rights to the forests. It has received a forest certificate from the Forest Stewardship Council and a government-approved Forest Management Plan guides its decision-making. According to this plan, the forest has been separated into management units so that intensive use is limited to specific areas of the forest for given periods of time. The forest management plan is supervised with the help of UZACHI technicians. However, the assembly of *comuneros,* composed of all the adult community members, determines most of the policies for the administration and use of the forest resources, as well as the administration of the communal sawmill.

Income from timber sales is invested back into the community, mostly for improvement of the municipal infrastructure. The benefits of a communally operated forestry firm are local jobs and further contributions to the municipal budget. While income from commercial forestry is not sufficient to meet all of the basic infrastructure needs of the small municipality, it does represent a crucial source of income, and it has helped to stimulate thinking and action in local forest conservation.

Case 3 – Community forestry in Honduras

Honduras is a country where 80% of the land slopes on grades of more than 15%, substantially limiting the areas where agriculture can be practised. Nevertheless, Honduras is rich in forests, with approximately 50% of the country forested. Many of the people living in and around forests see communal forestry as a way to improve their livelihoods, and many of them are organizing themselves to take advantage of new legislation that has moved legal control of large forest tracts from national administrations to municipal governments. Honduras is an interesting example of government-supported institutional forestry reform and of local people trying to address forestry-related problems by forming cooperatives.

There are more than 80 locally formed forest product cooperatives in Honduras, the majority of which work in the area of resin collection. Other cooperatives deal with timber, including a few that have evolved from manual milling to more sophisticated techniques. For example, in the country, the market control of resin has progressively been restricted to three firms, mostly because of the low prices that the large resin-collecting companies can offer. This limits the opportunities for local producers who cannot compete with the large companies. To overcome these drawbacks, the cooperatives have amalgamated into federations in order to deal more effectively with common problems, with the objective of organizing transport to sell resin in neighbouring countries for better returns.

Recently, local community leaders, managers from forest-related cooperatives, and officials from the Social Forestry division of the Honduran Forest Service met in the small community of Yamaranguila to discuss forestry issues. Some of the problems raised by community leaders at this meeting were the difficulties in finding resources to cover the costs of producing management plans (which must be done before timber is harvested) and the lack of land ownership that limits access to forests. The community leaders addressed the benefits of a potential new forestry law that would help clarify these issues.

Forests currently managed by municipalities require that municipal mayors sign and forward petitions to the national government before local use can occur. Although mayors are locally elected, in many cases they are nominated by political parties whose headquarters are located in the Honduran capital Tegucigalpa, and they spend most of their time there. While some community leaders reported that their mayors were helpful in preparing and forwarding forest-use requests, others reported that their mayors were frequently absent and did not seem interested in advancing the paperwork required for local access to resources or for transport of lumber. The most helpful mayors were found in the indigenous Lenca municipalities where forest protection and environmental

movements have been organized for more than 20 years. The bureaucratic paperwork would be eliminated if cooperatives were granted access to the forests as owners.

Representatives of local cooperatives and government officials are now encouraging reform legislation with the objective of clarifying the norms that regulate local access to forests. The reform is also aimed at increasing local control over forest access, developing less costly management plans and promoting management of forest resources with the participation of local communities.

5. Attributes characterizing community forestry

The IFRI Research Programme is a multicountry programme that functions through an international network of Collaborative Research Centers (CRCs) in South America, Asia and Africa. IFRI carries out field research by gathering comparable data about the relationships between rural communities and their forest resources (IFRI 2002). Each CRC uses multidisciplinary teams and the same ten research protocols to collect data on the biophysical conditions of forests at designated sites, and on related socioeconomic, demographic, cultural and institutional variables. Techniques such as participatory rural appraisal, surveys and interviews with key informants are used both individually and during group meetings.

The purpose of this section is to examine the role of local institutions in forest management. Because local forest users seldom take national forest legislation at face value, that is, they will not automatically obey rules without considering their effects on either their individual or collective interests, forest management by user groups and its effect on forest conditions depends to a large extent on how forest users organize themselves. The local rules or institutions for forest management determine the effectiveness of such organizational efforts by constraining or rewarding specific types of behaviour among user-group members. Consequently, local institutions play a mediating role in forest governance. In this section of the chapter we will test the hypothesis that local efforts by forest-user groups to collectively organize forest harvesting, marketing, and monitoring are positively related to superior forest health.

The analysis occurs in two parts. In the first part we propose conditions under which collective activities are expected to occur by looking at local variation in several attributes of the resource and of the forest users. Our purpose is to provide contextual background for the 34 sites that we consider in the analysis (Table 2, overleaf). The descriptive statistics that we present illustrate the variety of local conditions that exist in our sample. In the second part, we analyze relationships among the local institutions and existing forest conditions at selected sites. We carry out a simple cross-tab analysis to test whether there is a statistically significant association between strong local institutions and good forest conditions.

5.1 Local conditions for communal forest management

Our analyses are based on attributes that were directly measurable through IFRI field research, such as property ownership type, degree of forest deterioration, predictability of forest products, size of forest, salience of forests, and the culture of cooperation among local users.

Earlier research (Ostrom 1992b; Gibson *et al*. 2000) showed the importance of **property rights** in excluding outsiders from forest exploitation and thereby for providing incentives to forest stakeholders to make forest improvements. While South American forests have differences in ownership and/or rights regimes – and some governments have conferred significant control of forest lands to local communities during the last decade – most countries have retained ownership of large tracts of forest resources under national or local governmental control.

Figure 1 (on p. 41) shows that about 50% of the sampled forest lands were in the public domain, owned by national and local governments, with local governments holding about 30% of the total lands. The other half of the forest lands were privately owned: 42% being

Table 2. List of the settlements, forest-user groups and forests sampled in this study.

Country	Settlement N = 34	User group N = 47	Forests N = 36
Bolivia	Huayco Grande	Rinconeños	El Huayco
	San Antonio de Juntas	User group of Belén Cruz	Belén Cruz
	Villa Aquiles	Property owners and tourists	Villa Aquiles
	Lagunillas	Property owners in Lagunillas	Lagunillas
	San Juancito	San Juancito community members	San Juancito
	San Lorenzoma	San Lorenzoma community	San Lorenzoma
	La Merced	Community La Merced	La Merced
	Corregimiento of Trinidadcito	Logging enterprise, local community and loggers	Trinidadcito
	Cachimayu	Settlers of Chapis	Chapis Cachimayu
	El Saire	Herders of Chapis	Chapis El Saire
	Huacanqui–Padacaya	Owners of Chapis	Chapis Huacanqui
	La Merced, Totora, Rio Negro, Ibare, Nueva Galilea	Settlers	La Merced, Totora, Rio Negro, Ibare, Nueva Galilea
	San Antonio de Misiones	Community and timber enterprises	San Antonio
	Santa Anita	Community of Santa Anita, livestock owners and loggers	Santa Anita
Guatemala	Morán-Naranjo	Community of Morán-Naranjo	Morán-Naranjo
	Community of Las Cebollas	Las Cebollas community members	Las Cebollas
	Finca	Community of San Jose	San José
	San Jose	Community of San Jose	State of San Jose of Minas
	Socorro	Community of Socorro	Forest of Socorro
	Tesoro Community	Tesoro	Tesoro community forest
	Finca Dulce Nombre	Tachoche	State of Tachoche forest
Honduras	La Campa Centro	Center of La Campa, cooperative of La Campa, independent potters and Lacamperos	Bosque Comunal de la Campa
Mexico	Capulalpam	Community of Capulalpam, and mushroom gatherers	Capulálpam
	Cerro Prieto	Ejidatarios' wives, ejidatarios, avenos, ejidatarios' sons and families	Cerro Prieto absorption area Cerro Prieto core zone
		Tourists	Cerro Prieto core zone
	Donaciano Ojeda	Irrigation committee 3rd Manzana, 2nd Manzana, 1st Manzana, community and families, and residents	Donaciano Ojeda
	Huayapam Centro	New residents and traditional settlers	Huayapam
	La Ponga	Invaders	Protective forest Loma Alta
	La Union, Loma Alta, Suspiro	Land owners in protective forest	La Union, Loma Alta, Suspiro

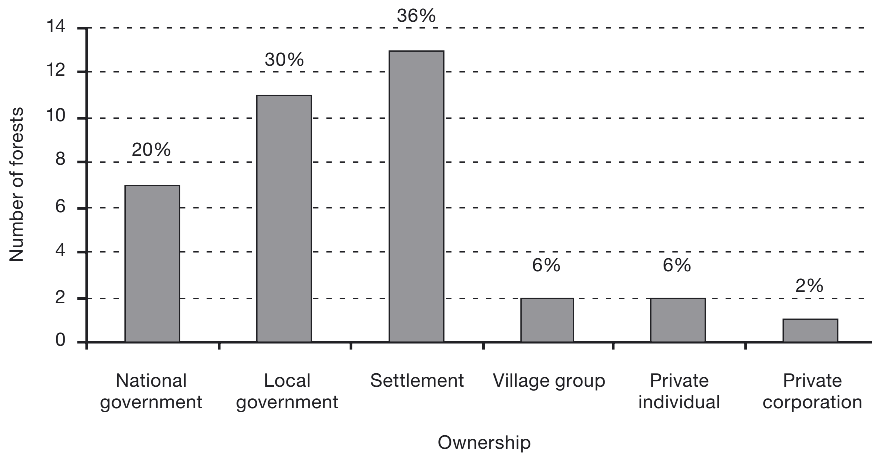

Figure 1. Breakdown of forest ownership in the 36 selected forests examined in this study (see Table 2).

held in common as property of the settlement or of a village group, with the remaining 8% held as private property belonging either to individuals or corporations. In trying to understand the conditions that would favour collective action, it seems reasonable to assert that those communities whose members hold forest rights in common would be more likely to develop institutions to manage the forests than would communities or individuals that use forests on government-owned lands. This is because the less secure the property rights are, the less certain are the prospects of recovering the resources that are managed or produced through collective activities.

Forest **deterioration** is another variable that helps to explain the motivation of forest-user groups in managing their forests. In order to come up with a better appreciation of the ways that forests can deteriorate (or lose value), four IFRI forest attributes were selected: vegetation density, species diversity, commercial value and subsistence value.

Based on evaluations by botanical experts, Figure 2 (overleaf) shows that the conditions of the case study forests vary a great deal among the samples, and that the values associated with forest conditions are more or less normally distributed. Most expert opinions fall into the ‘about normal’ category. The attributes of roughly one-fifth of all forests assessed were considered to be in poor condition (very sparse or somewhat sparse), and a slightly higher proportion were considered to be in good condition (somewhat abundant or very abundant).

Expert botanists used rapid visual assessments to determine forest vegetation density and species diversity. The commercial and subsistence values of forest resources were analyzed using data on the principal forest products (whether used for subsistence or trade), collected according to IFRI’s protocol. The following possibilities were offered to assessors for each variable: very sparse, somewhat sparse, about normal for this ecological zone, somewhat abundant, and very abundant.

We expected to see better conditions, that is less deterioration, in forests managed by user communities with a higher level of institutional development. This is because communities that have developed ways to work together effectively will generally do a better job of controlling access to a resource, thereby reducing the adverse effects of competition. A forest in good condition can also be an important stimulant for continued institutional development. People who do not have access to a forest in good condition may not have enough at stake (= a cost–benefit assessment) to be motivated to self-organize and assume management responsibilities for the resource.

The **predictability** of forest products, that is, their availability from season to season, is also important for the cost–benefit calculations that forest users undertake when making

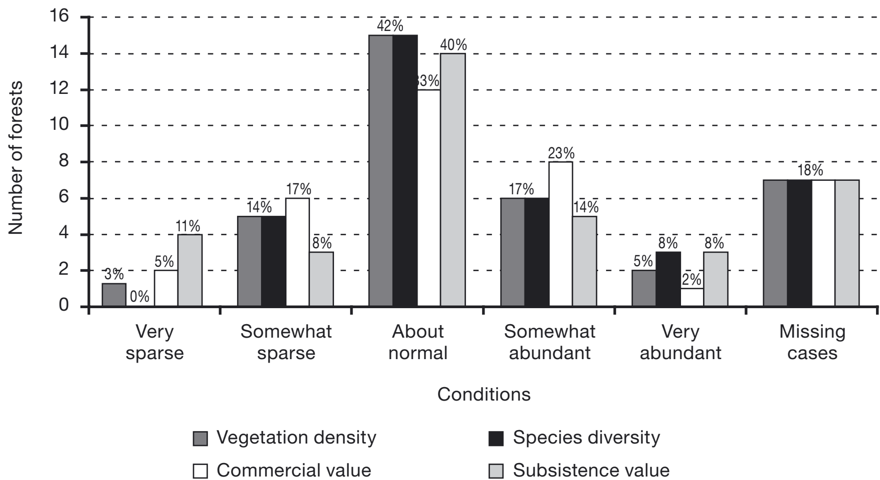

Figure 2. Assessment of forest conditions in 36 forests examined in this study (7 missing cases) developed by expert botanist members of IFRI teams. Six categories are used to define different forest conditions, based on the assessment of tree density and floristic richness.

decisions about whether to engage in collective management activities. The temporal variability of resources is recorded in Figure 3, and we note that more than half (53%) of forest products are perceived as not varying from season to season. Fifteen percent of products are viewed as having little or moderate temporal variation in availability, and products varying substantially and dramatically only reach 10% and 8% respectively. Fourteen percent of the forest products lack this data and are considered missing cases.

Our expectation was that communities facing higher levels of uncertainty in forest product predictability would be less motivated to organize and establish the rules for collective actions required to manage a forest and its resources. Such uncertainties are more likely to discount the perceived net benefits to be gained from organizing.

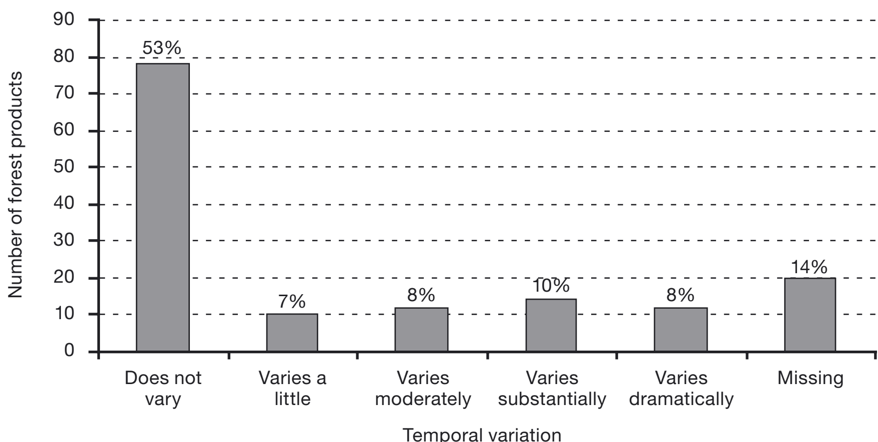

Figure 3. Predictability of future (next year) availability of 146 forest products in 36 forests (20 missing records). Temporal variation is described using six categories.

The **size** of forests is one of the more influential contextual variables that motivates community self-organization in forest management. We found that 52% of the sampled forests were less than 500 hectares, 28% fell in the range of 501 to 3000 hectares, and 20% were more than 3000 hectares (Figure 4). Forests managed by forest-user groups are relatively small: 89% of the forests are less than 5000 hectares.

Nevertheless, the effect of forest size on the development of community forest management is not a direct relationship. For example, those communities with access to larger forests can have difficulty in establishing regulatory bodies to limit access to outsiders, monitor extraction of products by outsiders, and monitor use of forest resources by members of the community entitled to them. Communities managing larger forests will also need more time and effort to develop institutions and to undertake actions that will result in better forest conditions. Furthermore, the capacity of a local user group to manage a larger forest will also be important. This can sometimes be evaluated by examining the ratio of forest size to the number of user-group members; there is usually an upper threshold of how much forest a given user group can effectively manage.

When analyzing **salience** of forest products for the people using them, we first asked how many households in the forest-user groups depend significantly on the forest for their own subsistence, which, on average, was 63% of the people interviewed. Secondly, we asked how community members derived their basic income. Combined responses showed that 63% of the people interviewed in the settlements derive their basic livelihoods from subsistence farming, 9% from commercial farming, and 9% through waged labour. Those people in the ‘other’ category (18%) gained their income mainly from artisanship and animal husbandry (Figure 5, overleaf).

Harvesting forest products was not ever given as the main source of income. As a result, we concluded that forestry activities are important for family subsistence but are a complementary source of income, secondary to income from agriculture and paid manual labour. Therefore, forest users’ main source of livelihood is a combination of agriculture for both subsistence and cash income, with gathering of forest products and hunting game for subsistence. The impact of forest users on the forests is thus complex. On the one hand, there is a need to clear old-growth forests for agriculture but, on the other hand, there is also a need to conserve forests for subsistence products.

Members of some communities will fail to create and enforce rules to counteract over harvesting, while others will succeed in creating and enforcing rules that constrain

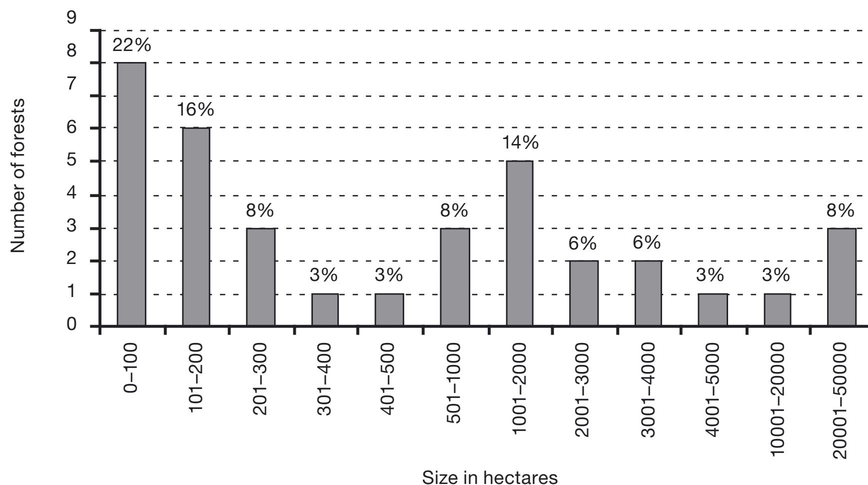

Figure 4. Assessment of the size of the forests (ha), across the 36 forest sites included in this study.

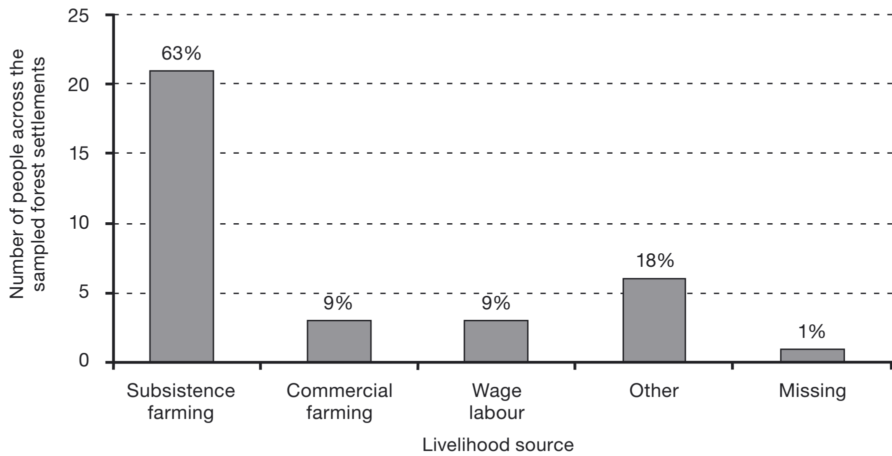

Figure 5. Assessment of rural livelihoods in 34 settlements (1 missing record). Four categories are identified. Other = income mainly derived from artisanship and animal husbandry.

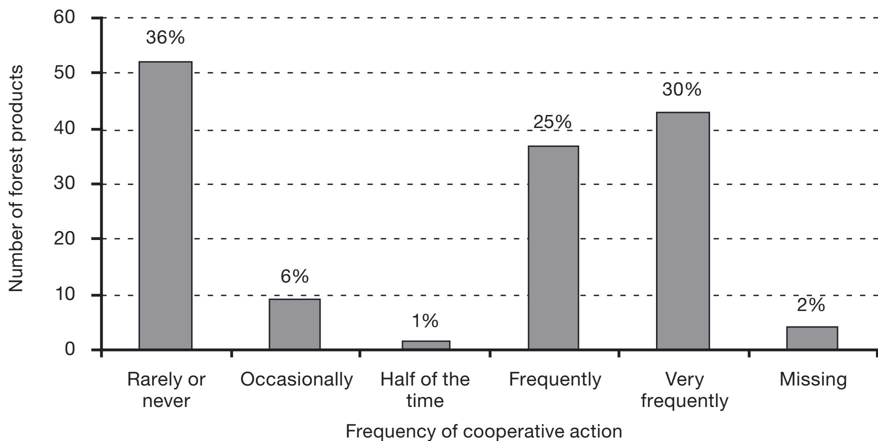

Figure 6. Assessment of culture of cooperation for the exploitation of 146 forest products (4 missing records). The 5 categories identified indicate the frequency of occurrence of cooperative actions with respect to the collection of a certain number of products.

resource-damaging individualistic behaviours and/or reward resource-enhancing behaviours that contribute to the collective good (Ostrom 1990). This success or failure is related to a community's **culture of cooperation**. Our assessment (Figure 6) focuses on rules in-use rather than rules in-form (e.g., national forest regulations). We partition the observed community responses into five categories ranging from 'rarely or never' cooperate to following the rules 'very frequently'. Our analysis was based on activities observed during the harvest of 146 forest products. For 36% of the forest products, user groups do not or rarely follow community-established rules in exploiting these resources, while for 55% of the forest products group members obey rules frequently or very frequently. The remaining 7% of the forest products fall in between these two extremes.

There was significant variation in the culture of cooperation among user groups. In our sample, those who engaged in more cooperative interactions with group members would be more willing to continue this behaviour as trust is developed and cooperation pays off. Those forest users that do not obey rules are less likely to develop trust and engage in the reciprocal behaviour that will, in turn, affect institutional development. We thus expect that user groups enjoying higher levels of trust would also cooperate more effectively when it came to forestry activities.

When we considered the combined average responses, we found that community forestry had developed under normal forest conditions in a variety of types of property regimes in relatively small forests where forests were important for subsistence, and where there was a greater culture of cooperation, and less so for commercial purposes, where there were no significant changes in the availability of products over time. We now address the issue of whether organizational efforts are associated with superior forest health.

5.2 Do local institutions matter?

If institutions influence the variables listed in Box 1, we would expect to see better conditions in forests where user groups are engaged in more highly organized collective activities. Here we use observations made of 47 IFRI forest-user groups to evaluate the significance of the relationship between their collective forestry activities and forest health, using a Chi-square test of the association between dichotomized variables as explained below. We chose the Pearson Chi-square test because it is well-known, easily executable in cross-tabs, and easy to interpret.

IFRI protocols query when and how often individuals in each user group interact, classifying the options as follows: year round, seasonally, occasionally and never. Among the categories of interaction specified in this ordinal variable, the most important for communal forestry management are cooperative harvesting, cooperative marketing, and cooperative monitoring/sanctioning. The frequency of interactions in such categories allows us to compute the degree of collective activity in the 47 forest-user groups. In order to simplify the analysis, we created two categories: 'high level of collective forest activities' and 'low level of collective forest activities'.

If the groups interacted only occasionally or if they never interacted we assigned them a 'low' level of collective forest activity and, conversely, if the groups interacted seasonally or year-round, we assigned them a value of 'high' collective forest activity.

We relied on the expert opinion of local foresters to assess forest health. At each site, we asked the expert to classify the forest according to an ordinal scale ranging from 1 (degraded) to 5 (very good). In order to simplify the analysis, we dichotomized this variable into 'good' vs. 'degraded' forest health, reducing the categories identified from five to just two (see Figure 2 and Table 3, overleaf). A forest is recorded as 'degraded' if forest conditions with regard to tree density and species diversity are described as very sparse or somewhat sparse, while a forest is categorized as 'good' if it is described as normal, somewhat abundant or very abundant.

The results of a cross-tab analysis are presented in Table 3. The results indicate that stronger local institutions for harvesting and monitoring forest resources are associated with superior forest health. This positive association is statistically significant at the 95% confidence level (Chi-square = 9.476, Df = 1, $P < 0.05$ for collective harvesting, and Chi-square = 4.102, Df = 1, $P < 0.05$ for collective monitoring).

Our results suggest further that the effects of local institutions are not the same for all aspects of forest management. For instance, we found no significant relationship between collective activities in marketing and superior forest health. Consequently, one cannot conclude that local institutions are sufficient to solve all kinds of collective problems. Another limitation of this analysis is that we cannot say what is enabling some user groups to organize their forest activities while others have not been able to do so. However, we do know that the sample includes a wide variety of local conditions, and it is not biased towards communities with a higher propensity for cooperation (Figure 6).

Our results are consistent with earlier findings in the literature about the importance of institutions as mediating or mitigating factors in forest management. For example, Agrawal

Table 3. Relationships between different types of collective activities of 47 forest-user groups and forest conditions. Df = degree of freedom, a measure of the precision of an estimate of variation.

Collective activities		Forest health		
		Degraded	Good	Total
Cooperative harvesting	Low	22	1	23
	High	10	8	18
Total		32	9	41
Chi-square test		Value	Df	Significance
	N=41 6 Missing cases	9.476	1	0.002
		Degraded	Good	Total
Cooperative marketing/ sales	Low	19	3	22
	High	12	6	18
Total		31	9	40
Chi-square test		Value	Df	Significance
	N=40 7 Missing cases	2.203	1	0.138
		Degraded	Good	Total
Cooperative monitoring/ sanctioning	Low	10	0	10
	High	22	10	32
Total		32	10	42
Chi-square test		Value	Df	Significance
	N=42 5 Missing cases	4.102	1	0.043

Df is equal to the sample size (2) minus the number of parameters estimated in the test, in this case 1.

and Yadama (1997) argue that institutions can reduce demographic and socioeconomic pressures on the forests of the villages of the Kuman region in India. Varughese (1999) studied the role of institutions that mitigated the dynamics of population change and group size to find that in 18 cases from Nepal population growth rates were not correlated with variations in forestry conditions, but collective action was. These same authors also concluded that ethnic, social and economic heterogeneity did not have a determining effect on either the likelihood or success of collective forest management.

The importance of institutions in various forest conditions was tested by Gibson *et al.* (2003) using more than 150 IFRI cases in 12 African, Asian and South American countries. They found consistency of rule enforcement to be more important than levels of cooperative forestry activities in explaining variations in the condition of community forest resources.

6. Conclusions

Forests are being degraded throughout the world and foresters, rural developers and environmentalists are searching for ways to reverse this trend and achieve sustainability of the biophysical landscape, biodiversity and rural livelihoods. In South America, many national governments have now concluded that local governments, communities

and individuals should become more active in managing forests. What types of local management arrangements are most appropriate in different contexts? This chapter has shown that when analyzing local forest management systems it is important to look beyond the forests and the trees to consider local institutions, that is, the rules and strategies that local people develop to organize their relationship with their forest environments. Our analysis suggests that there is a clear and positive correlation between strong local institutions, collective activities and good forest conditions. Government officials need to appreciate the role of local institutions in forest governance when they transfer forest management and ownership to local communities, and they must ensure that appropriate support is given to institutional development in communities that assume these responsibilities.

Social scientists have developed useful tools for analyzing the factors that influence the effectiveness of local user groups in forest management. However, research on communal forestry management should be conservative when generalizing results, since the combination of resources and user attributes varies from situation to situation. Often, simply copying policy solutions from one biophysical, socioeconomic and cultural setting to another does not work. Careful analysis is needed to understand what makes some institutional systems more effective than others.

Research carried out under the IFRI Research Programme provides a useful approach to studying community forestry institutions, as it draws on broad, reliable and comparable sets of time-series data from a large number of community-managed forests around the world. Another of the strengths of the programme is that it provides a systematic way of studying how people interact with forest resources, permitting the measurement of the impact that communities have on forests. Although in this study we used foresters' opinions to gauge forest conditions, we are currently working with a group of forest ecologists to develop methods that will allow IFRI scholars to compare forest conditions based on more objective and measurable forest data. We believe that collaboration between social and natural scientists is key to gaining a better understanding of the role of local institutions in efforts to improve forest governance. Interdisciplinary researchers concerned with human–ecological interactions have a great deal of challenging and exciting work ahead as they study the world's forests and their users.

References

Agrawal, A. 2001. Common property institutions and sustainable governance of resources. World Dev. 29:1649-72.

Agrawal, A. and J. Ribot. 2000. Analyzing decentralization: a framework with south Asia and east African environmental cases. World Resources Institute, Washington, DC, USA.

Agrawal, A. and G. Yadama. 1997. How do local institutions mediate market and population pressures on resources? Forest Panchayats in Kumaon, India. Dev. Change 28(3): 435-465.

Andersson, K.P. 2002. Can decentralization save Bolivia's forests? An institutional analysis of municipal forest governance. School of Public and Environmental Affairs and Department of Political Science, Indiana University. Bloomington, USA.

Andersson, K.P. 2004. Who talks with whom? The role of repeated interactions in decentralized forest governance. World Dev. 32(2):233-250.

Arnold, J.E.M. 1990. Social forestry and communal management in India. Rural Development Forestry Network (RDFN), Overseas Development Institute (ODI), London, UK.

Arnold, J.E.M. 1992. Community forestry: ten years in review. Community Forestry Concept Note. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

Arnold, J.E.M. 1998. Managing forests as common property. Food and Agriculture Organization of the United Nations (FAO) Forestry Paper. FAO, Rome, Italy.

Ascher, W. 1995. Communities and Sustainable Forestry in Developing Countries. ICS Press, San Francisco, USA.

Baland, J.-M. and J.-P. Platteau. 1996. Halting Degradation of Natural Resources: Is There a Role for Rural Communities? Clarendon Press, Oxford, UK.
Becker, D. and R. Leon. 2000. Indigenous forest management in the Bolivian Amazon: lessons from the Yuracaré people. *In* People and Forests: Communities, Institutions and Governance, (C. Gibson, E. Ostrom and M.A. McKean, eds.). MIT Press, Cambridge, USA.
Berkes, F. (ed.). 1989. Common Property Resources: Ecology and Community-Based Sustainable Development. Belhaven Press, London, UK.
Bhatt, C. 1990. The Chipko Andolan: forest conservation based on people's power. Environ. Urban. 2:7-18.
Bromley, D.W. 1991. Environment and Economy: Property Rights and Public Policy. Blackwell Press, Oxford, UK.
Bromley, D.W., D. Feeny, M. McKean, P. Peters, J. Gilles, R. Oakerson, C.F. Runge and J. Thomson, (eds.). 1992. Making the Commons Work: Theory, Practice, and Policy. ICS Press, San Francisco, USA.
Clugston, R. and T. Rogers. 1995. Sustainable livelihoods in North America. Development 3 (September):60-3.
Contreras, H.A. and T.M. Vargas. 2001. Dimensiones sociales, ambientales y económicas de las reformas en la política forestal de Bolivia. Proyecto de Manejo Forestal Sostenible and the Center for International Forestry Research, Santa Cruz, Bolivia.
Dei, G. 1992. A forest beyond the trees: tree cutting in rural Ghana. Hum. Ecol. 20(1):57-88.
Douglass, M. 1992. The political economy of urban poverty and environmental management in Asia: access, empowerment and community-based alternatives. Environ. Urban. 4(2):9-32.
Feeny, D., F. Berkes and J.M. Acheson. 1990. The tragedy of the commons: 22 years later. Hum. Ecol. 18:1-19
Feeny, D., F. Berkes, B.J. McCay and J.M. Acheson. 1998. The tragedy of the commons: 22 years later. *In* Managing the Commons, (J.A. Baden and D.S. Noonan, eds.). Indiana University Press, Bloomington, USA.
Ghai, D. 1993. Conservation, livelihood and democracy: social dynamics of environmental change in Africa. Osterreichische Zeitschrift fur Soziologie 18:56-75.
Gibson, C. and F. Lehoucq. 2003. The local politics of decentralized environmental policy in Guatemala. J. Environ. Dev. 12(1):28-49.
Gibson, C.C., E. Ostrom and M.A. McKean. 2000. Forests, people, and governance: some initial theoretical lessons. Pp. 227-242, *in* People and Forests: Communities, Institutions and Governance, (C. Gibson, E. Ostrom, and M.A. McKean, eds.). MIT Press, Cambridge, USA.
Gibson, C.C., J. Williams and E. Ostrom. 2005. Local Enforcement and Better Forests. World Dev. 33(2):273-284.
Hernáiz, I. and D. Pacheco. 2001. La ley INRA en el espejo de la historia: Dos siglos de reforma agraria en Bolivia. Fundación Tierra, La Paz, Bolivia.
IFRI (International Forestry Resources and Institutions) Research Programme. 2002. Field Manual. Center for the Study of Institutions, Populations, and Environmental Change, Indiana University, Bloomington, USA.
McCay, B.J. and J.M. Acheson (eds.). 1987. The Question of the Commons: The Culture and Ecology of Communal Resources. University of Arizona Press, Tucson, USA.
McCay, B. and J.M. Acheson. 1990. Human ecology of the commons. *In* The Question of the Commons: The Culture and Ecology of Communal Resources, (B.J. McCay. and J.M. Acheson. eds.). The University of Arizona Press, Tucson, USA.
McKean, M.A. 1992. Success on the commons: A comparative examination of institutions for common property resource management. J. Theor. Polit. 4(3):247-82.
McKean, M.A. 2000. Common property: what is it, what is it good for, and what makes it work? Pp. 27-56, *in* People and Forests: Communities, Institutions and Governance (C.C. Gibson, M.A. McKean and E. Ostrom eds.). MIT Press, Cambridge, USA.
Ostrom, E. 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Pp. 298. Cambridge University Press, New York, USA.

Ostrom, E. 1992a. Crafting institutions for self-governing irrigation systems. ICS Press, San Francisco, USA.

Ostrom, E. 1992b. The rudiments of a theory of the origins, survival, and performance of common-property institutions. Pp. 293-318 *in* Making the Commons Work: Theory, Practice and Policy (D.W. Bromley ed.). ICS Press, San Francisco, USA.

Ostrom, E. 1998. The international forestry resources and institutions research programme: a methodology for relating human incentives and actions on forest cover and biodiversity. Pp. 1-28 *in* Forest Biodiversity in North, Central and South America, and the Caribbean: Research and Monitoring. Man and the Biosphere Series, Vol. 21 (F. Dallmeier and J.A. Comiskey, eds.). United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, France; Parthenon, New York, USA.

Ostrom, E. 1999. Self-governance and forest resources. CIFOR Occasional Paper 20 (February):1-15. Centre for International Forestry Research (CIFOR), Bogor, Indonesia.

Ostrom, E. 2003. How types of goods and property rights jointly affect collective action. J. Theor. Polit. 15(3):139-170.

Ostrom, E. and V. Ostrom. 1999. Public goods and public choices. Pp. 75-105 *in* Polycentricity and Local Public Economies (M. McGinnis ed.). The University of Michigan Press, Ann Arbor, USA.

Ostrom, E. and J. Walker. 1997. Neither markets nor states: linking transformation processes in collective action arenas. Pp. 35-72 *in* Perspectives on Public Choice: A Handbook (D.C. Mueller ed.). Cambridge University Press, Cambridge, UK.

Ostrom, E., L. Schroeder and S. Wynne (eds.). 1993. Institutional Incentives and Sustainable Development. Westview Press, Boulder, USA.

Ostrom, E., C. Gibson, S. Shivakumar and K. Andersson. 2002. Aid, incentives and sustainability: Institutional analysis of international development cooperation. SIDA Studies in Evaluation No. 02/01. Swedish International Development Cooperation Agency (SIDA), Stockholm, Sweden.

Pacheco, P. 1999. Estilos de desarrollo, deforestación y degradación de los bosques en las tierras bajas de Bolivia. CIFOR (Centre for International Forestry Research), CEDLA (Centre for Latin American Research and Documentation), Fundación Tierra, La Paz, Bolivia.

Perry, J. and R. Dixon. 1986. An interdisciplinary approach to community resource management: Preliminary field test in Thailand. J. Develop. Area 21(1):31-47.

Peters, P. 1994. Dividing the Commons: Politics, Policy and Culture in Botswana. University of Virginia Press, Charlottesville, USA.

Poteete, A. and E. Ostrom. 2002. In pursuit of comparable concepts and data about collective action. Presented at the CAPRI Workshop on Methods for Studying Collective Action, Nyeri, Kenya. Available from the Workshop in Political Theory and Policy Analysis, Indiana University. Bloomington, USA.

Raju, G., R. Vaghela and M. Raju. 1993. Development of People's Institutions for Management of Forests. Viksat, Nehru Foundation for Development, Ahmedabad, India.

Richards, J.F. and R.P. Tucker. 1988. World Deforestation in the Twentieth Century. Duke University Press, Durham, USA.

Scott, J. 1998. Seeing like a State. How Certain Schemes To Improve The Human Condition Have Failed. Yale University Press. New Haven, USA.

Swaney, J.A. 1990. Common property, reciprocity and community. J. Econ. Issues 24(2):451-462.

Tucker, C., E. Salvador and K. Andersson. 1999. Resumen preliminary del trabajo de campo de CIPEC en Capulalpam, Oaxaca, Mexico, 3–27 Mayo 1999. Centre for the study of Institutions, Population and Environmental Change (CIPEC).

Urioste, M. and D. Pacheco. 2001. Las Tierras Bajas de Bolivia a Fines del Siglo XX: Tenencia, Acceso y Uso a la Tierra y los Bosques. PIEB (Programa de Investigación Estratégica en Bolivia), La Paz, Bolivia.

Varughese, G. 1999. Villagers, Bureaucrats and Forests in Nepal: Designing Governance for a Complex Resource. Political Science and SPEA, Indiana University, Bloomington, USA.

Wade, R. 1994. Village Republics: Economic Conditions for Collective Action. Cambridge University Press, Cambridge, USA.

Wiesner, B. 1990. Harvest of sustainability: recent books on environmental management. J. Dev. Stud. 26:335-41.

Winter, M. 1998. Decentralized natural resource management in the Sahel. Associates of Rural Development. Burlington, USA.

Wunsch, J.S. and D. Olowu (eds.). 1995. The Failure of the Centralized State: Institutions and Self-Governance in Africa (2nd edn.). ICS Press, San Francisco, USA.