Chapter 3

Forest Resources: Institutions for Local Governance in Guatemala

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Forests are complex sets of resources. They can generate multiple products, both consumptive and nonconsumptive, that mature at different times. Some may be common-pool resources, while others are private goods, and still others are public goods providing ecosystem services for regions, countries, and continents. Forests may also be valuable for their absence—the land they cover may be worth more to individuals than their trees.

Given the many and possibly overlapping biological and economic characteristics of forests, their effective governance is not a straightforward issue. While in many countries of the Americas ownership by centralized governments has been the norm for at least the last fifty years, few national governments can afford the extensive level of monitoring required by the number and size of their legal forest holdings. Most national governments have discharged their forest duties by selling concessions to logging companies, ignoring many of their other gazetted management duties. The result has been unimpressive forest management and increasing global concern over the fate of forests (Arnold 1998).

The challenges confronting those interested in the governance of forest resources at the local level are also daunting. Individuals living near or in forests face the same large and complex set of forest characteristics as do governments. These individuals must also contend with the varied preferences of others if they seek to manage a community forest. Even if locals develop internal institutional solutions, they may be challenged by various types of outsiders—ranging from predatory governments to other resource-hungry communities living nearby in an ever-changing economic and political arena. The obstacles to constructing effective institutions to manage forest resources at the community level are substantial.

Nevertheless, individuals at the local level have successfully constructed institutions in some locations. When will this happen? When will this fail? Ostrom (chapter 1, this volume) provides a general theory of institutional creation for managing common-pool resources. She argues that individuals will create and sustain rules about forests only when they see greater benefits than costs in doing so. Ostrom also provides lists of attributes regarding resources and users that affect the cost-benefit analyses of individuals. Ideally, these attributes can be systematically tested to explore the compelling issues and theories regarding the governance of forests. Such cost-benefit analyses are important steps forward in our understanding of how people interact with their forests, how they might construct rules to govern their forest resources, and how such knowledge may be put to use in advising the governments, donors, and nongovernmental organizations that seek alternatives to conventional models of forest management.

In this chapter I contribute to the analysis of forest governance by identifying the necessary conditions for the creation of institutions regarding the management of common-pool resources. I argue that at least two conditions are necessary: dependence and scarcity (Gibson et al. 1998). I examine and illustrate these two conditions with examples of institutional creation in two communities in Guatemala. The data for this chapter were collected using the protocols of the International Forestry Resources and Institutions Research Program, a collaborative network of researchers. The IFRI program seeks to understand the impact of institutions on forests by collecting and analyzing socioeconomic and ecological data from the local level (Ostrom 1998; see also the IFRI Web page at www.indiana.edu/~ifri). Teams of researchers representing multiple disciplines spent around one month at each site conducting interviews and taking biophysical measurements, including a sample of forest plots the fieldwork for Morán took place in June and July 1996, Las Cebollas in une 1998).

At each site, the communities possess attributes that many observers believe o be crucial for the creation of self-governance, such as prior experience with building institutions and a general lack of external government interference. The individuals in these cases did not, however, automatically create institutions to govern their valuable common forest resources, even though both communities have the skills and experience to do so. Instead, the communities built institutions where they viewed the resources on which they depend o be scarce.

The Necessary Conditions for Institutional Creation

When do members of a community construct institutions to manage their natural resources? This is a central question for those exploring local-level natural resource management. The answer is, of course, far from straightforward. Scholars have presented many sets of conditions and offered hundreds of cases in their efforts to explain the success and failure of collective action regarding natural resources (e.g., Agrawal and Yadama 1997; Bromley 1992; Gibson et al. 2000; McKean 1992; Wade 1994; Libecap 1989; Ostrom 1990; Baland and Platteau 1996; Ostrom et al. 1994; Arnold 1998).

Researchers generally emphasize the costs and benefits that accrue to individuals from group action. If the difference between the costs and benefits of constructing an institution to manage a resource is not positive, no incentive exists for individuals to invest their time, efforts, or money in the enterprise. For example, while a majority of people in a community would stand to gain if a rule about harvesting was in place, the costs of discussing and agreeing on such a rule could be greater than the future stream of benefits to the individual. Or if ethnic tensions exist among members of a community, the costs of constructing an institution to manage a natural resource are greater than in a community with more harmonious relations. In a cost-benefit calculus, the expected net positive benefits of an institution provide incentives for individuals to craft management rules. Such research is, of course, in part a matter for empirical study: Such conditions and factors will be present to varying degrees and interact in different ways over space and time. If enough cases employ similar concepts and agree on units of measurement, comparisons can be made to determine which attributes at what levels are more important than others to promote collective action (see Ostrom and Wertime, 2000).

Instead of offering my own list of the attributes of users and resources most important to institutional creation, I argue that two conditions are necessary for the emergence of self-governing institutions for natural resources. These two conditions—dependence and scarcity—must be present before individuals will incur the costs of establishing and enforcing their own rules.

Dependence and Scarcity

If we assume that individuals generally act when it is in their interest to do so, two conditions are necessary before they will expend the effort to manage a commonly held natural resource (in this study we address forest resources). First, individuals must view themselves as dependent on some forest resource (see Ostrom's attribute A1). The reasoning for this condition is straightforward. Unless a resource provides some benefit, individuals will not incur the costs entailed in constructing an institution to manage it (and such costs can be quite high since, at a minimum, individuals must cope with the processes of decision making, monitoring, and enforcement structures [e.g., Perrings 1995; Ascher 1995]). Note that dependence is not the same as an economist's concept of value. Economists define value by scarcity; dependence does not

necessarily imply scarcity. All humans depend on the breathable atmosphere, while for economists, its plenitude obviates its value. Dependence does not need to be defined in terms of pecuniary benefits. Community members may be highly dependent on sacred or recreational forests, and may consider it worth their time and effort to manage them.

Although the dependence condition appears somewhat trivial, it continues to frustrate conservationists as they seek to build projects with the help of local communities. The things that conservationists value (conservation, biodiversity, carbon sinks, intact biomes) may not be the same as those on which local communities depend (Bailey 1996). Locals may not see themselves as dependent on ecosystem-level collective goods. Community members, therefore, must be induced with other benefits (more money, land, or resources, less erosion, cleaner water, and the like) to participate in such schemes. Such projects are fragile because these other benefits generally do not last when the projects end (Carrasco 1993).

Despite its obvious nature, dependence is also quite difficult to measure precisely, especially across cases. As economists have discovered in their attempts to measure the "total economic value" (TEV) of a resource (total economic value includes the benefits of direct use [e.g., timber and nontimber forest products], indirect use [e.g., ecosystem services], option values [e.g., potential revenues from less consumptive enterprises such as tourism], and existence values [e.g., sacred forests or totem animals; Pearce and Moran 1995]), most communities depend on forests for specific products. Dependence on each product, in turn, is affected by conditions such as the availability of substitutes, location of markets, and local household economic strategies. Further, subsets of the community may be dependent on different products, making it difficult to derive any single accurate measure of the dependence of an individual or a community on a forest's resources.

The IFRI protocols used in this study employ a number of measures to determine how individuals depend on a forest, including perceived levels of dependence on the forest for important resources, amounts harvested, availability and cost of substitutes, distribution of dependence within the community for each product, uses for each product, changes in product levels over time, and so on (IFRI Field Manual 1999).

The second condition necessary for the emergence of self-governance is scarcity: Individuals must perceive a resource to be scarce before they will contribute to a collective solution. If individuals view a resource as plentiful, they will not be willing to endure costs to manage it. This condition is also relatively well known to both academics and conservationists. Indeed, anthropologists following Boserup's (1965) thesis of population-induced agricultural intensification argue that without scarcity there are few reasons for people to create and maintain rules about resources (e.g., Harner 1975: 125; Johnson and Earle 1987: 10–11; Netting 1993: 157–188). Perception is key here. For example, if little land for extensive migration actually exists, but if people perceive that they can use up a forest's resources and move on, they will be less inclined to organize to manage their current actions and resources.

In sum, the conditions of dependence and scarcity must both be present before members of a community will engage in the construction of institutions to manage their natural resources. If individuals do not see themselves as dependent on a resource, they will not organize to manage it whether or not it is scarce. If individuals do not perceive a resource as scarce, they will not organize to manage it whether or not they are dependent on it.

Dependence, Scarcity, and Institutions: The Cases of Morán and Las Cebollas

Although located in different parts of eastern Guatemala, the communities of Morán and Las Cebollas share many characteristics. (See figure 3.1.) The

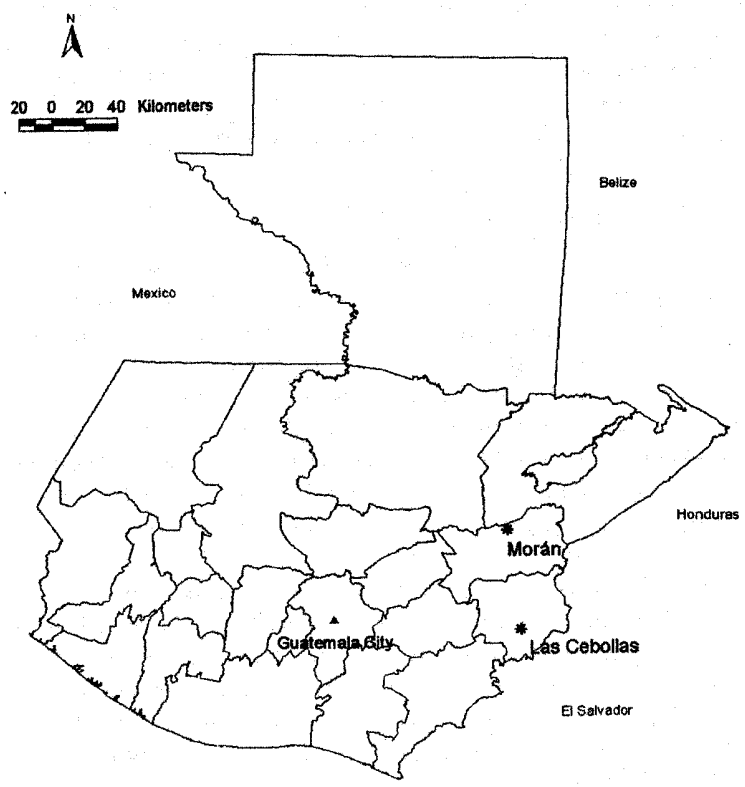

Figure 3.1. Location of study sites in Guatemala.

members of both communities practice subsistence agriculture. They depend on forest products for fuelwood, timber, and cattle grazing. And they are also largely left alone by national and subnational governments, which have allowed them to craft local institutions regarding their natural resources.

The pattern of institution-crafting we find in Morán and Las Cebollas illustrates the importance of the dependence and scarcity conditions. The residents of both communities have established institutions to manage agricultural land, which is considered valuable and relatively scarce. The communities have approached forest management differently, however. Members of Morán have not constructed many rules about their forest's use. It remains an open-access forest for community members. The Las Cebollas community possesses a similar open-access forest that locals use extensively. But community members have also created and enforced rules that prevent harvesting from a particular forested patch, called the Protective Forest. Because locals in these communities do not view the product streams from most of their forests as scarce, they have no incentive to invest in creating institutions to manage them, even though they are dependent on their products. However, part of the Las Cebollas forest was seen by locals as essential to the production of water for agriculture. This perceived scarcity of water helped to motivate families in Las Cebollas to create the rules for a Protective Forest even as the community ignores the ongoing depletion of other forested areas.

The Settlements of Morán and Las Cebollas

The community of Morán is located at 1,200 m above sea level within the watershed of the Río Santiago, a subwatershed of the Río Motagua in the Sierra de las Minas mountain range (see table 3.1 and fig. 3.2). The community falls inside the political borders of the department of Zacapa and the municipality of Río Hondo. Morán is also located within the buffer zone of the Sierra de las Minas Biosphere Reserve. Morán is composed of sixty-nine households; the people of Morán are campesinos, or subsistence farmers, practicing milpa agriculture traditional to most Central America. The most important crops are maize and black beans. Locals also grow other tropical crops (e.g., coffee, plantains, manioc, yams) and fruit trees (e.g., oranges, mangoes), but these are secondary in importance to maize and beans. Agriculture is almost entirely for direct consumption by households, though small amounts of excess harvests are sold in the regional market. Cattle are also important as a form of wealth and financial security. Fields and pastures are found mostly on steep slopes within the Río Santiago watershed. All households seek additional land, since soils can be exhausted and the amount of land that is flat enough for crops is limited.

Land tenure in Morán is complex, involving several layers of legal demarcations, usufruct rules, and biosphere reserve management policies. According to cadastral maps of the Sierra de las Minas Biosphere Reserve, the majority of the area now utilized by Morán for agriculture, cattle pasture, and extraction of forest resources is municipal or *ejido* land locally called El Sitio. Within El Sitio are located communal agricultural lands (*trabajaderos*) worked and fenced together by community members. Also, smaller usufruct plots, known as *tierras con dueños* ("lands with owners") are found in El Sitio. Rights to work in these plots, though not formally considered legal by the Guatemalan government, are recognized by the community members and can be inherited, sold, and rented. Apart from the municipal lands, mostly in the northern extent of the Río Santiago watershed, are found *tierras privadas,* lands legally demarcated as privately owned. However, just as in the municipal lands, individual or family usufruct plots *con dueño* are scattered across the land demarcated as private. As delimited by the Master Plan of the biosphere reserve, Morán and the majority of lands economically important to its residents fall within the buffer zone of the reserve; within the buffer zone the law allows the sustainable use of resources to better the quality of life of its inhabitants.

The characteristics and practices of the Las Cebollas community are similar to those of Morán. Las Cebollas is located in the municipality of Quezaltepeque, in western Guatemala (see fig. 3.3). The community has claims to approximately 1,850 ha of land, much of it on slopes of about 1,500 m. As in Morán, the residents of the forty-three households that make up the community practice subsistence milpa agriculture (although coffee growing is an increasing practice). The site was settled during the early nineteenth century on land formally belonging to their respective municipalities (*ejidos*). Las Cebollas, like Morán, consists of land parcels belonging to households and unclaimed land operating as a commons. Legally, these lands remain municipality-owned *ejidos* if the original settlers or their descendants never obtained title to the land. However, de facto residents have developed elaborate and well-defined use rights over these lands. Individual parcels are typi-

Table 3.1. Characteristics of Study Sites in Eastern Guatemala.

Site	Year Settled	Elevation (meters above sea level)	Number of Households	Area of Forest Community (hectares)	Distance from Market (round-trip minutes walking)
Morán	≈1800	1,200	69	117	400
Las Cebollas	≈1880	1,500	43	867 (protective = 14)	270

Source: IFRI data forms.

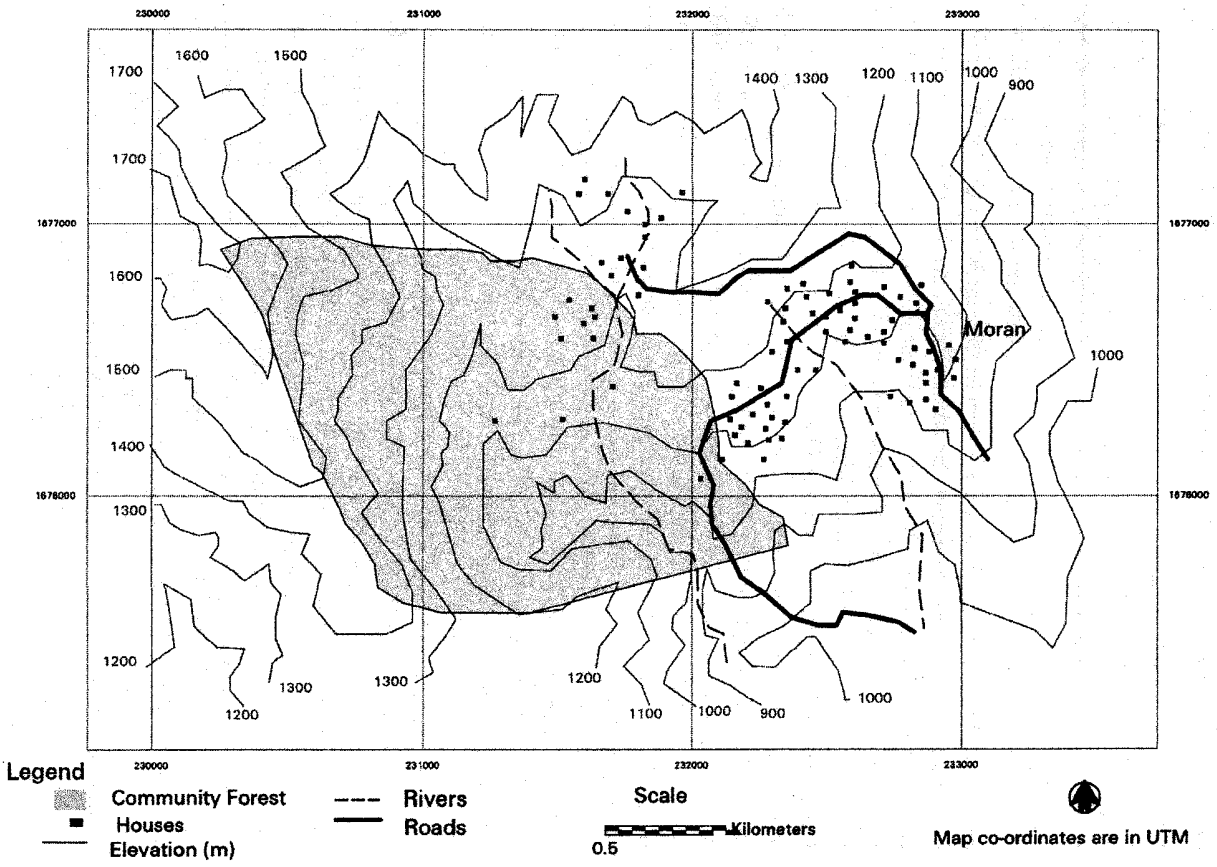

Figure 3.2. The Morán settlement.

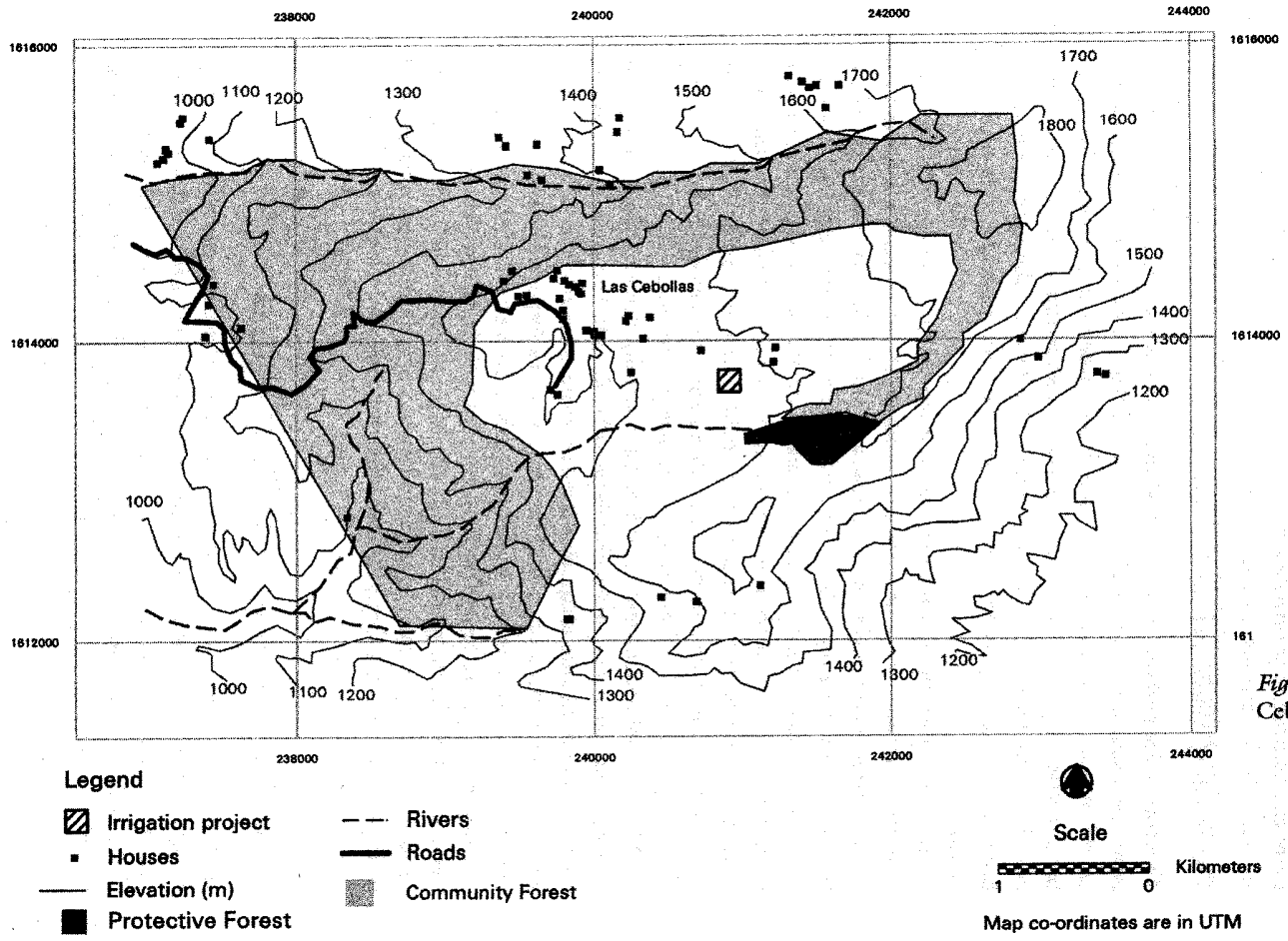

Figure 3.3. The Las Cebollas settlement.

cally fenced and respected by all local residents. Unlike Morán, Las Cebollas is not near any government-owned nature reserve, nor do large de jure private plots exist within its borders.

The Forests of Morán and Las Cebollas and Their Use

The forests located on the lands of Morán and Las Cebollas are typical of the area: open-canopied pine/hardwood forests that show obvious signs of sustained human use. Locals use these forests for three main purposes: (1) extraction of *ocote,* or resinous pine, for kindling; (2) extraction of firewood, oak varieties being preferred because they produce less smoke (though pine is sometimes used); and (3) pasture areas for cattle that feed on the ground-cover vegetation.

In addition to these three main uses of the forest, residents of both communities enter the forest for a number of other products. Locals cut down trees for the construction of fences, homes, and sheds. They occasionally collect plants for medicinal uses. Rocks and stones are sometimes removed from the forest for building purposes. Some families in Morán also hunt in the surrounding forests, although little wildlife remains in the areas around the communities. Based on the estimates of the field teams that gathered the data in these settlements, both communities are nearly entirely dependent on their community forests for fuelwood, timber, and pastureland.

Members of Morán and Las Cebollas generally perceive the major products of firewood, ocote, and pastureland to be abundant in their forests. While most members acknowledge that it takes more time to walk to gather firewood, or find that certain species are less abundant (especially hardwood varieties of trees) than in years past, they see this as an inconvenience, not a crisis. No doubt the steady out-migration from both settlements, resulting in relatively slow population growth in the two communities, has helped this perception. Also, while some members understand that the amount of pastureland s limited, they express that it is satisfactory for the number of cattle owned by ndividuals.

Natural Resource Institutions in Morán and Las Cebollas

Both communities have constructed rules about the resources on which they are dependent and which they perceive as scarce. In Morán and Las Cebollas, one such resource is farmland. Good agricultural land is in short supply and is highly valued. This is especially true in Morán, given the Sierra de las Minas Biosphere's policy that prevents changes in land use in its buffer zone. The dependence on and scarcity of arable land has led community members to convene annual meetings to decide on the allocation of arable land within El

Sitio, to negotiate rental and sharecropping contracts regarding plots of farmland, and to establish and enforce rules regarding the use of fire in clearing fields. The ubiquitous barbed-wire fences around land indicate that community members also take individual actions to protect this natural resource. In Las Cebollas, community members also have established rules about the use and exchange of land.

Although community members depend heavily on their forests—forest products are clearly salient to everyone's lives—locals in Morán and Las Cebollas perceive no scarcity in the flow of fuelwood, timber, or pasture. According to the argument proposed here, this means that residents will not create rules to manage these resources.

Qualitative evidence supports this argument that residents of Morán and Las Cebollas have few if any rules about the use of their large community forests: In the dozens of interviews we held with virtually every community member, we could find few formal or informal local rules related to influencing the amount or kinds of forest products harvested by residents. Community members at both sites repeatedly said that if a community member wanted firewood or timber, all he or she had to do was cut or collect it.

Quantitative evidence also supports the hypothesis. If community rules about the use of the forest existed, we would expect that certain patterns of forest use would be reflected in the biological condition of the forest itself. For example, if a community had a prohibition on the cutting of large oak trees, we would expect to find more large oaks than if the community did not have such a rule. Or, if a community prevented cattle from grazing in the forest, we would expect to find more ground cover, shrubs, and saplings. If no rules exist about a forest, on the other hand, we would expect that the pattern of use might be predicted by optimal foraging theory (Stephens and Krebs 1986; Hayden 1981; Smith 1983; MacArthur and Pianka 1966; Winterhalder 1981). In short, in the absence of rules, individuals should harvest the easiest and most rewarding forest products first.

I constructed two regression models to test the hypothesis that residents of Morán and Las Cebollas use their forests in a pattern consistent with optimal foraging theory. Using data gathered from randomly distributed plots in each forest, the models attempt to include both natural and human factors that may affect the forest. I selected pine as an indicator species since locals use it for fuelwood and construction. The forest measure used here, tree density, is commonly used as an important indicator of forest condition. The biophysical variables employed here as independent variables are also widely used to account for variation in forest conditions (Spurr and Barnes 1992).

The unit of analysis is the forest plot. At each site, plots were randomly distributed over the area of the forest. In the plots of Morán, three concentric circles were established of 10, 3, and 1 m radius. In the 10 m radius circle, all trees

with a diameter at breast height (DBH) ≥ 10 cm were measured for their DBH, height, and species name; in the 3 m radius circle, the same information was recorded for all saplings and shrubs 10> DBH > 2.5; the species and percentage of cover was recorded for the 1 m radius circle. In the plots of Las Cebollas, the same information was obtained in square plots of 10, 5, and 1 m. Information from each was scaled based on the square meters of each plot. In addition to the biological survey data, other data were recorded, including slope, slope orientation, elevation, and evidence of livestock, insects, and fire (IFRI Field Manual 1999).

For each site, I tested a tree density model. The form of the model is

$$Y_1 = I + X_1\hat{a}_1 + X_2\hat{a}_2 + X_3\hat{a}_3 + X_4\hat{a}_4 + X_5\hat{a}_5 + X_6\hat{a}_6 + å$$

where

Y_1 = TREE DENSITY, the number of pine tree stems per meter per plot
X_1 = ELEVATION, elevation of plot in meters above sea level
X_2 = SLOPE, percentage of slope of the plot
X_3 = INSECT, dummy variable for observed insect damage to trees in plot
X_4 = DISTANCE TO SETTLEMENT, the shortest distance in meters from a plot to the closest house in the community's settlement
X_5 = DISTANCE TO ROAD, the shortest distance in meters from a plot to the community's road
å = a random disturbance term

In this model, I hypothesized that since pine is an important species to locals—for firewood, *ocote,* and timber—the impact of using pine trees would be captured by the number of tree stems remaining in each plot. Individuals should harvest the most accessible trees first.

The first four independent variables attempt to control for the most important biophysical factors that may affect the size of pine trees (see table 3.2). The independent variable *elevation* is the elevation of the forest plot, measured as meters above sea level. The number of pine trees per plot should decrease with elevation. *Slope* is the steepness of the forest plot, measured as a percentage plot (e.g., 45 degrees = 100 percent slope). The number of trees should decrease with increases in slope since trees on a gradient have more difficulty establishing and maintaining themselves. But this variable might also capture human intervention, as it may be more difficult to access trees on steeper slopes. Higher levels of *insect* damage may also prevent growth or kill trees (Spurr and Barnes 1992).

The last two independent variables attempt to capture the human effects on the number of pine trees in Morán's forest. *Distance to settlement* is the independent variable representing the distance, measured in meters, between forest plots and the closest house in the Morán and Las Cebollas communities. If

Table 3.2. Regression Estimates for Pine Density Models.

Independent Variables	DBH Morán	DBH Las Cebollas	Tree Density Morán	Tree Density Las Cebollas
Intercept	76.67	−22.735	.78	−73.31
	(10.795)	(53.669)	(6.6)	(31.14)
Tree density	−0.983***	−0.688		
	(.315)	(0.4)		
Elevation	−0.04***	.008	.002	.064**
	(..011)	(.038)	(.007)	(.019)
Slope	−1.363	14.48	1.2	−18.23**
	(8.429)	(13.09)	(5.15)	(7.535)
Insect	−3.008	27***	−0.563	−4.63
	(3.11)	(8.65)	(1.9)	(5.85)
Distance to settlement	.066*	.00003	.017	.007**
	(.044)	(.005)	(.027)	(.003)
Distance to road	0.185*	.001	0.2***	−.003
	(.121)	(.005)	(.064)	(003)
R^2	.66	.54	.57	.58
	(6.987)	(7.37)	(4.2)	(5.11)
F	12.369***	2.33*	703***	3.62**
N =	33	19	33	19

* = significant at the p < .15 level
** = significant at the p < .05 level
*** = significant at the p < .001 level

community members are trying to maximize their return to effort, then plots closer to settlements should contain fewer pine stems than plots located farther away. *Distance to road* captures the distance, also measured in meters, from the one major road in each community to a forest plot. Because it would be easier for individuals to transport pine products by road to their homes or fields, pine trees would be taken from plots closer to the road. Thus, as distance from road increases, we expect to see an increase in the number of pine stems per forest plot.

The results of the models for Morán and Las Cebollas are presented in table 3.2. Taken together, they provide evidence that in the absence of rules, the residents of the two communities use their forests in an optimal foraging pattern.

The tree density models perform relatively well for both sites (R^2 = .57 and .58). In Morán, the model suggests that distance to road is a significant

predictor for the number of pines found within a plot. Using the beta coefficient from this independent variable, the model predicts an increase of twenty more pine stems per plot with every 100 m increase in distance from Morán's road. The same model for the Las Cebollas community forest also finds a distance variable significant, distance to settlement: The model predicts an increase of seven pine trees per plot for every 1,000 m of distance from the settlement. The other significant independent variables—elevation and slope—are also in their hypothesized directions.

Taken together, these models provide some support for the hypothesis that in the absence of rules, people follow an optimal foraging theory for gathering resources. Since hauling fuelwood and timber from the forest takes effort, we would expect people to take more and larger products from the closest and easiest locations. Although residents of Morán or Las Cebollas depend on them, these forest products are not considered scarce, and no rules have been created to limit or alter their harvesting. The open-access nature of these community forests is seen in the distribution of pine trees remaining in the forest.

Scarcity and Forest Rules in Las Cebollas

But this is not quite the full story for the Las Cebollas site, because in addition to their open-access community forest the residents in Las Cebollas have established a Protective Forest within which all harvesting of products is disallowed. I argue that the perceived scarcity of a resource they depend on—in this case water—motivated the establishment of the Protective Forest.

Ten of the wealthier families in Las Cebollas obtained a loan from BANDESA (the National Agricultural Development Bank) of Guatemala in 1986 to establish an agricultural scheme designed to augment their incomes. The families used the monies to construct an irrigation system so that they could produce vegetables during the dry season to sell in the nearby markets of Quetzaltepeque and Chiquimula. Through their interactions with development organizations such as PROZACHI (Program for Rural Development: Zacapa–Chiquimula) and PAF-G (Forest Action Plan for Guatemala), the families understood that forests were important to securing water for their irrigation system. They believed that protecting the watershed's vegetation would protect the flow of river water that fed their new system. To this end, the families succeeded in having the community declare a 14-ha area of forest as protective (of the watershed). The residents of Las Cebollas agreed to disallow the harvesting of any forest products, such as firewood or timber, or the grazing of cattle within this area.

These rules are enforced: The families that helped to found this patch of protected forest regularly walk its boundaries, which are clearly marked with a combination of paths and barbed-wire fences. The community is also small enough in membership and size so as to make undetected transgression of these rules difficult. Consistent with these factors, our forest plot teams encountered neither foraging cattle nor community members seeking fuel or timber in this forest patch for more than two weeks.

These rules have had an obvious effect on the condition of the forest. The Protective Forest boasts the most diverse vegetation of all the forested areas studied at Las Cebollas and contains the largest number of different species and the largest trees. Ground cover was also more dense than in other parts of Las Cebollas partly because of the prohibition on cattle grazing. Some of these differences can also be attributed to the microclimatic conditions of the Protective Forest, much of which is located in a moist ravine. Table 3.3 presents some of the stark differences in forest indicators between the Protective Forest and the open-access community forest.

The Protective Forest boasts nearly 50 percent more stems per area and more than twice the average DBH of pine trees than the open-access community forest, as well as almost twice as many saplings. Additionally, in a comparison with its own open-access forest, another nearby community forest, and two privately managed forests, the Protective Forest posted significantly higher measures for tree and sapling density, as well as tree and sapling basal areas (Gibson et al. 1999). These indicators reveal that some community members of Las Cebollas have created rules that have led to a successfully managed forest.

The Morán and Las Cebollas cases help to illustrate the necessity of the dependence and scarcity conditions for institutional creation. The members of each community have created institutions to help manage their agricultural lands, which they perceive as scarce and on which they depend. For the most part, while dependent on products of their forests, residents have not taken the same steps to create rules to govern the use of their forests: The goods they use are not seen as scarce. Because there are no rules, residents use the forests in an optimal foraging pattern. Members of Las Cebollas did, however, create forest institutions when they deemed water to be necessary and scarce.

Table 3.3. Forest Conditions in Community and Protective Forests of Las Cebollas.

Forest	Tree Density (stems/m^2) (all species)	Sapling Density (stems/m^2) (all species)	Average DBH (cm) (pine species)
Community	.062	.101	24.7
Protective	.087	.184	58.5

Moving Beyond the Necessary Conditions of Institutional Creation

To improve outcomes, many contemporary forestry policies in developed and developing countries are seeking to shift some control over forest management to the community level (Arnold 1987). Recognizing that communities may have the ability to monitor and enforce rules about forest use, policymakers have turned to various ways of devolving authority over forests to local people, usually without privatization. These policy moves signal that some governments are beginning to realize that the 500 million people who live in and around the world's forests will greatly determine the success or failure of forest policies (Arnold 1998).

In a fundamental sense, the local governance of forest resources will help determine the success or failure of important international environmental agreements, such as the United Nations Framework Convention on Climate Change and the subsequent Kyoto Protocol. No matter what national elites agree upon, it is behavior at the local level that produces aggregate outcomes. The signing of international environmental treaties by government officials does not automatically result in better policy design or better implementation on the ground. As they have for years, people in rural areas will filter, alter, or ignore a central government's forest policy. They also create their own rules, generating local institutions and patterns of activity that can diverge widely from the expectations of legislators and bureaucrats.

This study examined such local institutions in two sites of eastern Guatemala. I argued that we can expect to find instances of local institutional creation when (1) residents depend on a resource and (2) they perceive it as scarce. As we saw in Las Cebollas, residents successfully constructed their own rules regarding their Protective Forest when they understood that it helped to guarantee the flow of scarce water to their irrigated crops. While this outcome was in a sense aided by state organizations (the National Agricultural Development Bank), it was constituted by the residents themselves. The individuals from Las Cebollas—and not any forestry enforcement agency—protect this section of forest.

Despite the importance of the locals to forest management, neither international bodies nor domestic governments have a good understanding of the role played by local institutions. Policymaking in the absence of good theory and data invites disaster. This chapter is one example of the work being undertaken to fill this knowledge gap and improve forest policy. An increasing number of theoretically driven studies seek to account for the variation in performance of local-level forest management practices (Stork et al. 1997; Gibson et al. 2000). These studies could have a crucial effect on the evolving nature of forest policy.

Three aspects of research on forests and institutions will help determine the magnitude of its influence on contemporary forestry policy. First, such studies require research designs that move beyond single case studies to test hypotheses with larger sample sizes. Case studies are, of course, irreplaceable: They provide the grist for hypotheses on which more general tests can be made. Unless idiosyncratic effects can be isolated from more general trends, however, policymakers will not be able to derive lessons for crafting better policies. Second, future research must also explicitly model the multilevel nature of forest policy. It is clear that under different conditions, the linkages between the international, national, regional, and local levels can be crucial in generating outcomes in the forest. The advent of remotely sensed data coupled with careful institutional analysis on the ground can help scale up the considerable number of extant case studies regarding communities and their forests (e.g., Liverman et al. 1998). Third, research needs to appreciate the impact of political institutions on forest management (e.g., Ames and Keck 1997; Silva 1997; Dauvergne 1997). The best technical plans for resource management are rarely, if ever, adopted without alterations based on political factors. Policymakers act under constraints imposed by political institutions, not just their environmental concerns. Understanding the systematic effects of these political institutions may explain a great deal of the variance in forest conditions observed on the ground.

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