Chapter 6

The Lack of Institutional Supply: Why a Strong Local Community in Western Ecuador Fails to Protect its Forest

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Introduction

Given the disappointing results of natural resource conservation policy in developing countries over the last three decades, scholars and practitioners have shifted their focus away from state-centered policies towards solutions at the local level (Ostrom, 1990; Hecht and Cockburn, 1990; Marks, 1984; Blockhus et al., 1992; Poffenberger, 1990; Bromley et al., 1992; McCay and Acheson, 1987; FAO, 1990; Ascher, 1995). While these authors offer different lists of the conditions believed necessary for successful resource management by local people, most analyses include three fundamental requirements. First, individuals from local communities must highly value a natural resource to have the incentive to manage it sustainably. Second, property rights must be devolved to those individuals who use the resource to allow them to benefit from its management. Third, these individuals at the local level must also have the ability to create microinstitutions to regulate the use of the resource. Although various scholars and practitioners may add other conditions they see as important, most agree that some form of these three—locals' valuation, ownership, and institutions—are central to successful natural resource management.

In the *comuna* of Loma Alta in western Ecuador, these three conditions initially appear to be met. Residents of Loma Alta consider their 1,650 hectares of tropical moist forest important for its products such as timber to sell, building materials, and game. Comuna members enjoy well-defined and secure property rights to their land, allowing individuals to make capital improvements to their plots, rent their

lands to others, and transfer their holdings to family members through inheritance. Finally, Loma Alta boasts a strong history of crafting local institutions to deal with community concerns. The community has successfully crafted institutional arrangements dealing with the provision of goods such as schools, health clinics, and wells, as well as electoral institutions that allow each comuna member a voice in the administrative proceedings and the selection of their leaders. The central government has recognized the comuna as the legitimate form of local government since the Law of the Comunas passed in 1936.

Despite their positive valuation of the tropical forest, their relatively secure property rights to land, and their rich history of crafting microinstitutions, the members of the Loma Alta community have not created microinstitutions to regulate the use of their tropical forest. Few local rules exist about the removal of forest products, the cutting of timber, the hunting of game, or the clearing of land. Although parts of the forest appear to be relatively healthy, over a third of the forest has been decimated by the exploitation of timber and the expansion of agricultural and pasture lands.

Some of the explanation for the forest's depletion can be found in the type of property rights the comuna has allocated to different parts of the forest. The one-third that is most exploited is the comuna's 'forest reserve," which has not been allocated to individual comuna members. This section's overuse conforms to outcomes predicted by well-known theories regarding open-access, common-pool resources. The other two-thirds of the comuna's forest has been allocated, and is in relatively better condition. And, yet, property rights alone do not explain the spatial variance of the forest's condition within the allocated areas. Some individuals with plots in the forest appear to cut selectively their plots, generating stands of secondary growth. Others, however, pursue plantation agriculture or cattle-raising, motivating them to clear the forest to expand their holdings. The result of this complex pattern of property rights and activities is a starkly patchy forest: nearly treeless areas are contiguous with sections of dense secondary growth containing a wide diversity of species, some endemic to the region.

This chapter seeks to explain why the members of Loma Alta have not created microinstitutions to protect and manage their forest. Unlike so many local communities in the developing world, Loma Alta does possess those institutional features considered necessary for the successful conservation of natural resources; yet it, too, has failed to create rules to protect its forest. We argue that the explanation for this failure of institutional supply requires an understanding of the forest's many user groups, the forest products they value, and their property rights to these products. We find that the pattern of incentives confronting Loma Alta's multiple forest users discourages the creation of institutions to govern forest use, despite the comuna's strong

institutional assets. Comuna members prize the immediate exploitation of certain forest products and do not recognize the critical public goods produced by the forest, especially watershed and climatic services. Only when comuna members substantially value the benefits of these public goods and overcome the collective-action problem of institutional supply will a local-level institution regulating Loma Alta's Forest be created.

We collected our data using the methods of the International Forestry Resources and Institutions (IFRI) research program. The IFRI program is a pioneering effort to study forests and their use by collecting and analyzing both social and biological data at the micro level. A central hypothesis of this program is that institutions significantly affect the use and condition of forests (see Appendix I to this volume).

This chapter has six parts. In the first part, we briefly review some of the core assertions made by scholars and practitioners regarding the supply of micro-institutions that govern natural resource use at the local level. The next part introduces the comuna of Loma Alta, reviewing its institutional history, decision-making structures, and property-rights institutions. In the third part, we present the biological data collected in the Loma Alta Forest. These data indicate that much of the forest is in relatively good shape, while some parts exhibit tremendous overuse. In an attempt to explain the variation of forest condition, we investigate the users of the forest, their use-patterns, and the rules that influence their behavior in the fourth part. We show that the groups that comprise the greatest contemporary threats to the forest's condition are comuna members and outsiders using unallocated land, and members who convert forest land to plantation agriculture. We present an analysis of these use-patterns in the next part, attempting to derive an explanation for the lack of institutional supply from the incentives of user groups. Creating institutions to manage natural resources is costly; such costs are increased by the multiuser, multiproduct nature of forests. In Loma Alta, individuals do not value the public goods generated by the forest, and the different streams of private benefits that accrue to individuals are not sufficient to motivate them to create rules to regulate forest use. In fact, the three most important user groups in Loma Alta—farmers, woodcutters, and outsiders—would experience significant losses in the short run if an institution restricted their use of the forest. We conclude the chapter by discussing how the pattern of user group behavior may be changed in an effort to prevent the Loma Alta Forest from being completely depleted.

Natural resource management and the local level

A growing number of scholars and practitioners recognize the crucial role played by local people in natural resource management (Ostrom, 1990; Hecht and

Cockbum, 1990; Marks, 1984; Blockhus et al., 1992; Poffenberger, 1990; Bromley et al., 1992; McCay and Acheson, 1987; FAO, 1990; Ascher, 1995; Agrawal, this volume). They argue that policies emanating from central governments generally give local communities few rights over the natural resources with which they live. Without legal claims to the stock or flow of benefits from these resources, locals have little to gain from protecting them or using them sustainably. Such conditions generate incentive structures that encourage individuals to "poach" natural resources, and discourage them from constructing or maintaining rules or institutions at the local level to regulate their resource use (Gibson and Marks, 1995). Because many governments lack the resources necessary to monitor and enforce their natural resource policies, this pattern of incentives often results in overexploited resources (Becker, Banana, and Gombya-Ssembajjwe, 1995).

Critics of exclusionary government policies assert that sustainable policies must include those individuals that live with the natural resource. Many conditions for successful local-level management have been put forward. Most writers, however, include three requirements: (1) locals must value the resource, (2) they must possess some property rights to the resource, and (3) they must construct local-level institutions that control the use of the resource (Bromley et al., 1992; McCay and Acheson, 1987; Ostrom, 1990; McKean, this volume). The reason for the first condition is clear—unless locals place sufficient value on the resource, they have no reason to incur costs to protect or conserve it. While this condition appears trivial, many scholars and public policymakers routinely ignore it, and think that individuals will somehow conserve resources for some national or global good. Most practitioners, however, have come to realize that people must perceive some individual net gains from managing a resource to agree to constrain their short-term use of it.

The second condition of successful local management highlights the importance of property-rights arrangements. While debate surrounds exactly which bundle of property rights is most efficient for the sustainable use of natural resources, considerable agreement exists that locals should have some stake in the resource relating to access, use, and the exclusion of others (McKean, this volume; Demsetz, 1967; Libecap, 1989; North, 1990;Ascher, 1995). Such rights allow locals to control the benefits and costs of a resource, and thus may offer a reason for people to manage it for the long term (Schlager and Ostrom, 1993).

Finally, scholars and practitioners often assert the need for local-level institutions in natural resource management schemes (Ostrom, 1990; Marks, 1984; Bromley et al., 1992). When compared to central government institutions, local institutional arrangements are considered better at providing, *inter alia,* rules related to access, harvesting, and management; fora that can respond to conflict quickly and

cheaply; and monitoring and sanctioning methods that are efficacious. Further, locals are more likely to create such institutions if their community enjoys a history of rule-making together, since the costs, benefits, and techniques of institution building will be well-known to the participants.

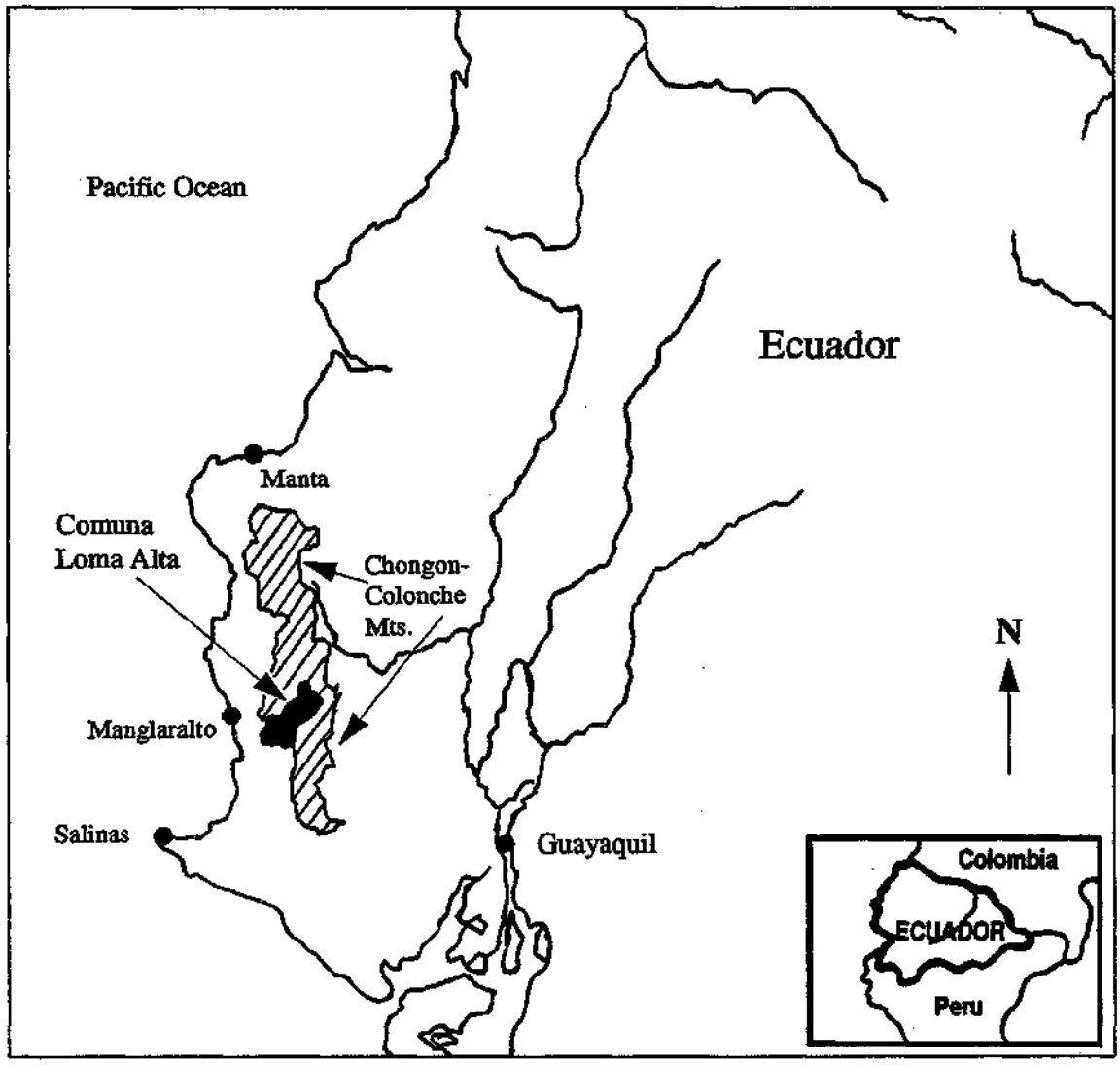
These three general conditions are by no means exhaustive of the requirements authors assert are important to the construction of successful natural resource management institutions. Others include: sufficiently small boundaries for the resource to be managed, a relatively small number of users, users who live near to the resource, users who are not strongly divided by cultural or ethnic differences, and users who perceive the rights system to be relatively fair. The case of the Loma Alta comuna in western Ecuador not only meets the three general criteria presented but fulfills almost all of the preconditions that scholars and practitioners consider important.

The social and physical assets of Loma Alta

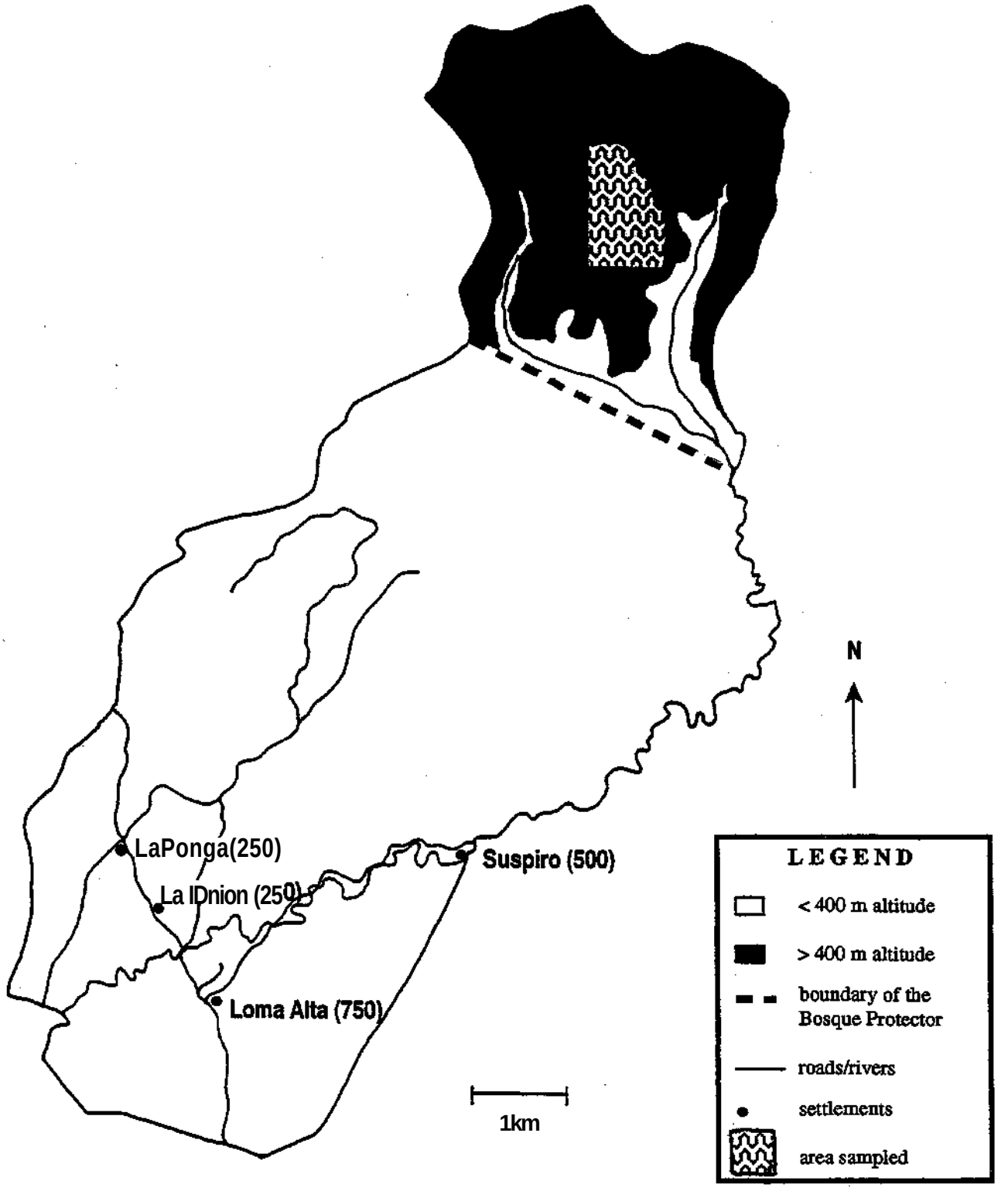
institutions

The Loma Alta comuna is a community of approximately 2,000 people who share property rights to 6,842 hectares of land in western Ecuador (see Map 6.1). The comuna members are distributed among four settlements—Loma Alta, La Union, La Ponga, and El Suspiro (see Map 6.2). Current residents recount how the settlements were established at the turn of the century by five families moving from more populated towns of the east and southwest who were seeking better opportunities for themselves; they especially sought to acquire land for agriculture. There were small numbers of peoples indigenous to the region, who had established land tenure patterns roughly based on the watersheds of the Chongon Colonche mountain range. The newer settlements continued this centuries-old pattern, as well as the linkages with small towns on the coast to supplement their household needs. These early settlers survived through subsistence farming and selling charcoal, timber, and straw hats to townsfolk.

In response to the actions taken by several coastal municipalities who were selling large tracts of land to urban dwellers during a period of land speculation, the central government passed the Law of the Comunas in 1936. This law formalized and augmented much of the traditional land tenure arrangements already found in the area. Individuals can petition a comuna to be a member when they reach the age of 18. Members pay an annual tax that is used to provide and maintain certain public goods in the comuna (health clinic, road, etc.). Governing the comuna occurs through two institutions. The comuna chooses a *cabildo* (council) each year in democratic elections decided by majority rule. Five officers comprise the cabildo—president, vice-



Map 6.1: Western Ecuador



Map 6.2: Loma Alta comuna and its bosque protector

president, treasurer, secretary, and legal advisor—who are responsible for the comuna's daily management. The cabildo officers also chair the monthly *asamblea* (community meeting) at which all comuna members make decisions collectively through majority votes. Members are expected to attend regularly, and can be punished if they are absent from the asamblea.[1] Members also frequently serve on various comuna committees (existing committees include child care, education, sanitation, and reforestation).

The most critical power of the comuna is its control over land. The 1936 law stipulates that the comuna as a whole owns the land and can allocate it to members for their use. In Loma Alta, a member must petition the comuna for land; *asambleas* usually grant most requests for plots less than 15 hectares (although many members possess more than one plot). Several rules constrain members' rights to their land. First, the comuna allocates land with the understanding that it must be used; plots left unused are subject to confiscation by the comuna. In practice, however, the interpretation of "use" is quite broad in Loma Alta: the comuna considers renting a plot to be a bona fide use, as well as keeping a field fallow for the regeneration of trees. No current member of Loma Alta recalls an incident in which the comuna has reclaimed land previously allocated. Second, an individual cannot sell their land to an outsider without the comuna's approval (by majority vote at an asamblea). To date, no land has been sold by comuna members.[2] Third, a member cannot rent land to anyone without comuna permission. Members, however, routinely flout this rule, renting land to other members without informing the comuna. Fourth, upon a member's death, land returns to the comuna to be reallocated. If any improvement to the land had been made by the deceased member, however, the comuna is required to compensate family members at the market price of the improvement(s). In practice, this compensation clause acts to promote inheritance. Since the comuna rarely has the money to recompense family members for improvements, sons and sons-in-law invariably receive their fathers' plots. No one in Loma Alta remembers an example of property reverting to the comuna after a member's death. Still, sons and sons-in-law often make official "requests" to the comuna for their fathers' land so as ensure this inheritance.

Comuna members respect each other's land boundaries. When the comuna decides to allocate a plot, a cabildo officer (or representative appointed by an officer) will travel to the plot site with the prospective user. The official, prospective

[1] *We experienced this first-hand. We needed a small shelter to be built in Loma Alta's Forest in order to sample the flora of our random plots. When no one volunteered their forest land for the structure, an absent member's plot was chosen.*

[2] *Two non-members, however, do hold title to private plots as a result of pre-1936 purchases. National and local governments respect the rights of those landowners whose purchases were completed before the enactment of the 1936 Law of the Commas.*

owner, and neighbors agree on the new boundaries, which can be either part of the natural landscape (river, ridge top, etc.) or constructed (with rocks, planted trees, etc.). This system appears to work relatively well, as comuna members and officials consider boundary disputes among comuna members to be rare. Incursions by individuals outside of the comuna, however, do occur. The most egregious example of such incursion occurs in the comuna's tropical premontane humid forest, which we discuss below.

Several consequences flow from this system of property rights to land. First, members hold considerable rights to their property: they are not restricted in their use of land, face few impediments when renting it, and can inherit land from family members. While they cannot sell their plots outright, they possess enough incentive to make considerable capital investments in the land, as evidenced by the number of houses built, wells sunk, fences constructed, trees planted, and irrigation trenches dug in Loma Alta. Thus, although the entire comuna system possesses some "communal" attributes, those allocated land within Loma Alta enjoy strong private rights to their property. As we will see below, these rights critically affect the use and condition of Loma Alta's Forest.

Loma Alta's "protective forest"

In 1986, Loma Alta sought assistance from Ecuador's central government to have its upland territory protected from encroachments made by members of a neighboring comuna. The area lies approximately 8 kilometers from El Suspiro, the nearest settlement, requiring three to four hours of travel time to reach (local residents travel on foot, mule, and horse). By 1987, the Ministry of Agriculture had demarcated the northern 1650 ha. of the comuna and declared it a *Bosque Protector* ("Protective Forest"; hereafter "the forest") (see Map 6.2).[3]

The forest exists on steep hills ranging in altitude from 200 m to 830 m. Along that gradient, vegetation changes from predominately tropical dry forest to a premontane humid "fog forest."[4] Much of the moisture required to support the moist forest tree species comes from the *garua* or fog season that lasts from July through November. Fog interception supports trees typically found in wetter regions of Ecuador and enables abundant populations of epiphytes to grow in the forest.[5]

Ecologists divide the forest into two ecological zones. Those parts above 400 m are dominated by premontane humid forest (Fundacion Natura, 1992).

[3] *"Protective" refers to the forest's role in protecting the watershed.*

[4] *Because the Loma Alta Forest is not above 2000 meters, it cannot be defined as a typical cloud forest, although fog forests share much of the same characteristics (see Parker and Carr, 1992). See also the work of Dodson and Gentry (1991) on the forest resources of western Ecuador.*

At elevations below 400 m, the forest shifts to dry forest, which contains more deciduous species. The transition between these two ecological zones is not abrupt. While the moisture of the forest increases from lower to higher elevations, the type of crops planted by Loma Alta's farmers does not vary much at elevations above 300 m—which includes almost all of the forest lands except river valleys.

For this analysis, another useful division of the forest follows the different property rights assigned to its parts by the comuna. Much of the northwest portion of the forest has not been allocated to individual comuna members, who call this area the *comuna reserve.* In this area, which we estimate to cover approximately 600 hectares, all comuna members may extract resources.[6] In the remaining 1,050 hectares of the forest, the comuna has allocated plots to individuals, who enjoy the bundle of rights discussed earlier.

The condition of the forest can be partly explained by these two different sets of property rights. The open-access nature of the comuna reserve has led to its severe degradation. An aerial photograph taken in August 1986 shows deforestation along the entire northern and western edge of the comuna reserve. At that time, about 50 hectares had been converted to pasture, and another 50 hectares had been cleared and cultivated. By August 1995, the pasture in the comuna reserve had been extended to cover approximately 350 hectares, and extensive timber harvesting had taken place on the rest. We estimate that as a whole, users' intensive exploitation of the comuna reserve has led to the removal of 75% of the area's forest cover.

In contrast, in the part of the forest that has been allocated to individuals, the forest is less depleted overall. However, the allocated areas display considerable variation over forest condition both within and between parcels. Such variance results from the different types of activities that landholders pursue on their plots. Those comuna members who are engaged in agriculture value the lands of the forest because of the increased humidity in the area. These farmers are slowly intensifying agricultural practices in the forest in response to the drying trend found at lower elevations.[7] Two major stream beds provide landholders easy access to this area during the dry season, as well as water for their crops from February through March.

[5] *Such fog forests are of intense interest for those concerned with the conservation of biological diversity, since they boast endemic species and the conditions favorable for future speciation (Parker and Carr, 1992). Because the Chongon Colonche range is adjacent to, but geographically separated from, the Andes, its evolutionary pathways are isolated sufficiently to give rise to new subspecies and species. Conservationists are currently working on strategies to maintain evolutionary processes in these areas.*

[6] *Comuna members are not clear about the borders of the area, and we were unable to survey the entire area. Further, the comuna does not possess a map of the reserve. Hence, the boundaries shown on Map 6.2 are our best estimate given discussions with comuna members, but lacking the groundtruthing that we plan to undertake in the next phase of our research in the area.*

Most of the comuna members with plots in the forest have responded to these favorable conditions by planting *paja toquilla* (Cariudovica palmate), the leaves of which are sold to the makers of panama hats. Farmers' holdings vary from approximately 5-12 hectares, with 1-3 hectares established as paja toquilla plantations. On these plantations, the forest is cleared of forest trees, burned, and planted with paja seedlings. In some of the remaining areas of their holdings, farmers plant crops such as citrus trees, plantain, tagua, banana, and coffee.[8] In between and among these crops can be found stands of secondary growth forest, although we estimate that only a handful of trees with a diameter at breast height (DBH) of more than 25 cm remain.

Woodcutters also own plots within the forest's boundaries, and it was on these plots that we conducted our most in-depth biological analyses.[9] Interestingly, the condition of the forest on woodcutters' plots is generally quite good. In 30 plots of 300 m^2 each, randomly distributed over 200 hectares of landholdings, only two plots had any recent (within the last 5 years) evidence of timber harvesting.[10] Additionally, we found no cases of current conversion to agriculture or pasture in these forest landholdings.

For some timber species in this part of the forest, it is obvious that sustainable harvesting has not been the norm, and the resource has been depleted. For example, only 4 of the 493 trees measured were the extremely valuable guayacan *(Tabebuia chrysantha),* and no saplings or seedlings of this species were recorded. Still, per hectare, our sampling found 30 preferred timber trees with diameters above 25 cm, and regeneration was occurring for many of these. Using this number as an estimator for the entire 200 hectares sampled in our study, about 5962 timber trees of harvestable size currently exist, or 5.7% of the trees (523 trees per ha. x 200 ha. = 104,600) we estimate to remain.

The size class distribution and the density of the current fog forest stand reflects the harvest of older, larger trees in the past. The mean DBH of trees with a DBH above 10 cm is only 21.8 ± 16.34 cm (N=492 trees), indicating a young or secondary forest structure.[11] Primary tropical forests are surprisingly consistent in propor-

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[7] The intensification of agriculture is not the result of population increases since the number of comuna members has remained fairly constant over the last two decades.

[8] Coffee was formerly the most valuable crop in the region before drought and disease destroyed most plants in the area.

[9] Because of the short duration of this pilot study, we sampled the areas of the forest considered the healthiest by comuna residents, forestry officials, and nongovernmental organization officials.

[10] We sampled the plant communities in the fog forest to determine what biological influences both past and present uses of forest have had, and to establish a baseline for monitoring the forest in the future. In this chapter, we focus on the condition of woody vegetation: trees, saplings, and seedlings in the forest. For this study, trees were defined as having a DBH >= 10 cm; samplings >= 2.5 cm but < 10 cm; and seedlings < 2.5 cm or a height of less than one meter.

tions of stems of a particular size (age) (Richards, 1975). As shown in Table 6.1, our data from Loma Alta's Forest deviates from the primary forest pattern in an expected way. In the secondary forest of Loma Alta, there are more small trees in the 10-20 cm category, and fewer large, older trees, explaining the low average stem diameter.

Table 6.1: Tree size classes in tropical primary forests vs. Loma Alta's secondary forest (The distribution is statistically different.)

Stem Class (DBH in cm)	Primary Forest % ± S.D.*	Loma Alta %
10 -19.9	44 ±4	60
20 - 20.9	28 ±2	22
30-30.9	18 ±2	8
40 and above	12±2	10

*** N = 7 primary forests; 3 South America, 2 Africa, 2 Asia (Richards, 1975:230).**

The density and diversity of mature trees with DBH greater than 10 cm are shown in Table 6.2. These structural and community features are consistent with expectations for a normal regenerating secondary forest. Typical of selectively harvested forests, the Loma Alta Forest has a high number of mature stems per hectare (523), and has patchy distributions of pioneer genera such as *Cercropia, Inga,* and *Geonoma.* Gaps created by the harvesting of the large timber trees are being filled by these fast growing soft wood and palm species. Species-abundance patterns are normal for tropical second growth forests with four or five dominant species, four or five subdominants, and a long list of less common species.

These findings are hardly what one would expect if the Loma Alta community had used its entire forest as an open-access resource.[12] Neither are they consistent with what we would expect if Loma Alta had constructed institutions to manage their forest resources, purposefully maintaining the 1,650 hectares of protective forest. Rather, variation of forest cover in Loma Alta's Forest reflects the practices of different user groups operating under different sets of incentives.

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[11] One extreme outlier, a Ficus ohtusifolia, was omitted from the mean and standard deviation because of the difficulty in obtaining an accurate measurement (Le., discriminating between above-ground root system and trunk). The recorded DBH (200 cm) is nearly twice that of the next largest tree. The range of the sample is 100 cm.

[12] For example, in a recent study of a Ugandan forest characterized as open access, over 50% of the plots hadevidence of charcoal making, timber harvesting, or commercial firewood cutting (Becker, Banana, and Gombya-Ssembajjwe, 1995).

Table 6.2: Diversity and density of trees (DBH > 10 cm) in Loma Alta's fog forest, Ecuador

Taxonomic Information (local names)	Stems per hectare	Est. % of Trees
I. Preferred Timber	**80**	**15.3**
Beilschmiedia spp. (Maria)	36	6.8
Ocotea spp. (jigua)	20	3.8
Cordia spp. (tutumbe)	10	1.9
Guarea spp. (chicoria)	8	1.5
Tabebuia chrysantha (guayacan)	4	.8
spp.? (figueroa, cedro)	2	.4
II. Taxon with more than 5 stems/ha	**345**	**66.0**
Gleospermum sp. (guayaba de monte)	76	14.5
Quararibea grandifolia (molinillo)	65	12.4
sp? (morocho)	32	6.1
Geonoma sp. (palma)	25	4.8
Cecropia spp.	23	4.5
Chrysophyllum sp. (mangillo)	19	3.6
Grias sp. (huevo de chivo)	16	3.0
Mapuira sp. (camaron)	15	2.8
Inga spp. (guaba de bejuco)	13	2.5
Pentagonia sp. (palo de murcielago)	13	2.5
sp? (pepito colorado)	10	1.9
Turpinia occidentalis	8	1.5
Ficus spp. (mono, cauchillo)	8	1.5
Rheedia sp. (amarillo)	6	1.2
sp? (miguelillo)	6	1.2
Phylotacea dioica (yuca de raton)	5	.9
Randia sp. (canafito)	5	.9
III. Taxon with less than 5 stems/ha	**54**	**10.3**
Prunus subcorymbosa (mamecillo)	4	
Sapium utile	4	
Zanthoxylum sp.	4	
Mauria sp. (mulato)	4	
Mollinedia sp. (cafe de monte)	4	
Pourouma sp.	4	
sp? (bijama)	3	
sp? (tabaquillo)	3	
Annona sp.	3	
Brosmium sp.	3	
Piper squamulosum	2	
sp? Anona de monte	2	
Ardisis sp.	2	
Bactris sp.	2	
Gutiferae sp.	2	
Phytelephas aequatorialis (tagua)	2	
Miconia sp.	2	
Psychotria sp.	2	
Tabernaemontana sp.	1	
Trema micrantha	1	
IV. Unidentified Trees	**44**	**8.4**

Users, user rules, and use-patterns

Different subsets of comuna and noncomuna members value the assets of their forest for different reasons. In this part, we examine the six most important user groups of Loma Alta's Forest: hunters, outsiders, wood users, commercial timber dealers, farmers, and woodcutters. Some, but not all, of the individuals of these groups overlap. The resultant pattern of users, products, and preferences helps explain the variance of the forest's current condition.

Hunters comprise one important group using Loma Alta's Forest. While populations of wild game in the forest have declined over the years, enough paca *(Agouti paca),* guatusa *(Dasyprocta punctata),* white-tailed deer *(Odocoilus virginiamus),* and red brocket deer *(Mazama americana)* exist to encourage locals to make the trek to the forest to obtain meat. Gomuna members seem to prefer the taste of game to that of domesticated animals (locals raise cattle, pigs, chickens, turkeys, ducks, and goats), but the price of game meat does not reflect this as game is not significantly more expensive. A trade in game meat does exist, but it is small and localized. Hunting is clearly secondary to residents' other activities. While it provides some additional protein to diets, it is not a critical supplement.

While the comuna has not established any formal rules regarding hunting within the forest, several norms appear to be respected by the hunters. First, individuals hunt alone or in small groups rarely exceeding four people; larger hunting parties are considered inappropriate. Second, hunters dislike spending nights in the forest, and so hunting trips of more than two days rarely occur. Third, comuna members disapprove of hunting for commercial gain. Those that do hunt generally eat what they kill, only occasionally selling small, extra portions to other comuna members.

Outsiders invading the forest constitute another significant user of the comuna's forest. The most important invader is a relatively wealthy, cattle-raising family living in a neighboring comuna (Dos Mangas). The family's employees have cut down the trees and burned the scrub on approximately 400 hectares in the northern section of the comuna reserve.[13] The area cleared corresponds to several of the denuded patches evident on the 1986 aerial photograph, and our own efforts at groundtruthing discovered that the fenced pasture has been extended to an even greater area. While the comuna has made some efforts to prevent this incursion—through such means as having the forest declared protected, cutting the wire fences that the family's employees erect, attempting to use the courts, and confiscating

[13] *Three additional invaders have used land within the Loma Alta comuna, but each affects plots of less than one hectare each.*

lumber taken by the family from that plot—Loma Alta has few efficacious enforcement mechanisms to protect their comuna reserve.

A third important group, which includes most of the comuna's residents, uses the timber of the forest for construction. While some residents construct their homes and shops with concrete block or stone (especially in the town of Loma Alta, which is the most commercial settlement of the comuna), most of the people living in the settlements of El Suspiro, La Ponga, and La Union use the hardwoods and bamboo gleaned from the forest to build their homes, fences, animal pens, and small stores. Locals prize guayacan *(Tabebuia chrysantha)* for cross beams, maria *(Beilschmiedia spp.)* for stilts, and jigua *(Ocotea spp.)* for floor planking. Bamboo *{Guadua spp.)* is used for internal and external walls, and is also an important fence-building material in all four of Loma Alta's settlements.

Individuals confront several choices in their efforts to obtain wood for construction. They can contract with landholders whose plots have the desired timber. They can also travel to a neighboring comuna to either poach or contract for timber. They can travel to the comuna's reserve—where land has not been allocated to any individual—to cut trees. Finally, they can contract with a woodcutter who will, in turn, cut the timber from the unowned reserve, negotiate with a landowner, or cut from a neighboring comuna. Comuna residents believe that the vast majority of wood currently taken comes from the comuna reserve. The constant use of this open-access area has resulted in local complaints about the increasing difficulty of finding the most-desired species for home building.

Individuals involved in the commercial timber business comprise another significant group of forest users—arguably the most critical user group when considering the forest's current condition. Timber was needed to build the coastal towns in the region (e.g., La Libertad, Barcelona, Manglaralto, and Santa Elena). As a result, from 1940 through 1960, commercial timber interests cut extensively from the entire Chongon Colonche range. Loma Alta residents claim that these outsiders continued to cut in their forest to supply the towns with wood; only within the last decade has the commercial activity tapered off. Typically, outside merchants would arrive with trucks and either contract with comuna members who held land in the forest, with members who were woodcutters, or try to cut wood in areas held by the comuna as a whole to avoid payment.

Few rules appear to have limited the activities of the commercial timber industry. The comuna did make a small attempt to capture the benefits from this lucrative industry by imposing a tax on wood leaving their territory. However, since the tax was nominal and loosely enforced, it did nothing to restrain the cutting

of trees. The intensity of this business has decreased noticeably with the concomitant reduction of commercially-valuable timber. Currently, only a few trucks come to Loma Alta with the intent to transport timber out of the comuna. The lack of valuable species and large trees in most of the forest is in part attributable to the extensive cutting of previous generations.

Since large-scale commercial timbering has declined, the user group comprised of the approximately 25 comuna members who have been allocated plots within the forest has the most significant effect on the condition of the Loma Alta forest.[14] Most of these landholders have cleared their plots to cultivate paja toquilla. Paja has been farmed in the area for at least the last 100 years. Its importance has grown over the past two decades due to the increasing demand for panama hats and the decline of its cash crop rivals—coffee and tagua. Comuna members have enjoyed a consistently growing demand for their paja leaves over the past generation; presently it is the most valuable agricultural commodity in the comuna, and all of Loma Alta's farmers wish to expand their holdings. Two factors constrain the expansion of paja farming. First, paja toquilla requires humidity to thrive, thus accounting for the fact that only those individuals with plots near and within the premontane humid forest are able to grow it extensively. Second, while paja toquilla is valuable, it is also labor-intensive. Most landholders cannot afford to hire the additional labor required to expand their holdings. The distance of the forested areas from the settlements adds to labor costs.

The comuna itself places few constraints on landholders who want to cut down trees and grow more paja toquilla. Landholders enjoy secure rights to their land because they have been allocated plots by the comuna. No comuna rules exist to protect forested land from being cleared. Although the central government has recently banned commercial timber cutting and the hunting of deer in the forest, locals disregard the law since the government has only one forest guard for approximately eight comunas. Again, only the distance to the forest and the lack of capital to pay for additional labor constrain a rapid expansion of paja toquilla plantations. The cabildo is, in fact, ready to allocate another five hectares to any of the forest landholders if they so desire.

The practices associated with the cultivation of paja toquilla thus help to explain the patchy condition of the forest in its southern parts. The forest's distance from the closest settlements (El Suspiro and La Ponga) encourages farmers to estab-

[14] *The comuna allocated most of these areas to individual landholders in the 1960s and 1970s. This coincides both with the increasing dryness of lower comuna land and with demand for paja toquilla, which needs humidity to thrive.*

lish plantations in the part of the forest closest to their homes. The shortage of labor prevents these plots from being very large.

The final user group we consider is comprised of the two individuals who hold land in the forest but who make their livelihoods by cutting wood rather than growing paja toquilla. The woodcutters selectively cut the trees on their own plots within the forest; the vast majority of the wood they sell, however, comes from the trees they cut in the comuna reserve. Because the trees in this area are almost free of cost—besides the costs of traveling to the reserve and extracting the timber—the woodcutters choose to deplete this land first, before they harvest from their own plots. Cutting from the communal plot also allows the trees on their land to "fatten" and thus become more valuable. The full-time woodcutters realize that they will be forced in the future to cut on their own plots to maintain their incomes. Demonstrating his belief that most of the valuable wood from the comuna reserve and individual plots will be removed relatively soon, one of the full-time woodcutters is "making connections" with members of another comuna in the hopes of either purchasing trees from its landholders, or getting access to land to continue his occupation of cutting and selling trees. The other woodcutter is "networking" with larger commercial timber companies to the north of the comuna, hoping to ensconce himself as the middleman between them and furniture makers located in coastal towns.

Incentives of user groups and the lack of institutional supply

The management of Loma Alta's watershed could provide substantial benefits to comuna members. A management institution offers the possibility of sustainable product flows, which would provide a more secure long-term supply of timber and other forest products to individuals. The institution could help protect the integrity of the comuna's borders, thus ensuring that outsiders would not exploit comuna resources. And the institution would allow comuna members to continue to benefit from two critical public goods provided by the Loma Alta Forest: climate maintenance and watershed services (e.g., fog interception, the prevention of erosion, groundwater storage, and water purification).

Along with these benefits, however, the creation of institutions to protect a natural resource entails considerable costs. It is costly to reach agreement between the members of a community about what rules should regulate forest use. It is costly to structure monitoring efforts that ensure these rales are not broken. And it is costly to resolve the disputes that will arise when rales are broken.

The physical characteristics of a forest also affect the costs of organizing a management institution. The fact that Loma Alta's Forest is relatively distant from the four major settlements makes any monitoring effort by comuna members more difficult than if they lived adjacent to its borders. Additionally, members of other comunas can enter the Loma Alta Forest easily—e.g., the forest is not protected by natural or artificial barriers—increasing the likelihood of invasion and requiring more monitoring activities.

To cover these significant costs, the users of the forest must perceive significant benefits from forestry management in order to desire and to contribute to the creation of institutions to regulate the forest's use. While users of Loma Alta's Forest value the forest for certain products, it appears that members of these groups do not perceive the benefits of a managed forest to be greater than its costs.

Individuals who hunt game in the forest and those who purchase wood to build homes have little incentive to create an institution to regulate the forest's use. The small number of game hunters do not depend on the forest for any significant portion of their livelihood. While they would benefit from a well-managed forest, since it would likely contain more game, the hunters stake in wildlife is relatively peripheral to their other daily activities.

Similarly, those individuals who use the forest's wood for constructing their homes have little incentive to shoulder the costs of forest management. While it is true that comuna members need wood to construct their homes, and that they would likely have to pay higher prices for wood in the future if all of Loma Alta's trees were felled, individuals reap the benefit of inexpensive wood in the present. Wood from the open-access comuna reserve is there for the taking; wood from the plots of private landholders is still available. Even if the forest was completely denuded, Loma Alta's residents believe that other comunas could meet their timber needs. Given the benefit that most members enjoy from the current lack of timber restrictions, most would not favor—nor be willing to support—an institution that might restrict forest use.

Thus, both game hunters and wood purchasers use the forest intermittently, have available substitutes for the forest products they value, and do not depend on the forest for their livelihoods. These two user groups share a pattern of incentives that mitigates their desire to contribute time, effort, or money to manage the forest.

Paja farmers, timber cutters, and outsiders, in contrast, use the forest intensively, perceive fewer available alternatives, and depend on the forest and its products for a significant portion of their incomes. Paja farmers claim that if they could secure more labor, or if the paths from their settlements to the forest were made

easier to travel, they would cut down more trees to plant more paja, their most valuable crop. Like the paja growers, the profitability of the woodcutters' activities depends on a consumptive use of the forest in the present. The woodcutters are already removing timber at a rate that presses them to plan for the day when the forest can no longer provide them timber to sell.

Neither paja growers nor woodcutters have an interest in institutional arrangements that restrict their use of the forest. Paja growers know that forest trees and paja plantations cannot coexist within the same plot; any limitations on the expansion of paja plantings would constrain their ability to increase their income. Woodcutters know that their use of the forest is nonsustainable. Their preference is to cut trees without restriction while trees still exist to cut. While their own plots within the forest may boast relative health, this may be an artifact of their ability to use the comuna reserve, rather than a demonstration of any commitment to sustainable harvesting techniques. As long as the comuna reserve contains trees, woodcutters have the incentive to cut from that area first. When the reserve is completely denuded, it is likely that they will cut extensively on their own plots or in other comunas.

The outsiders who use the forest also favor the absence of forest regulations. The cattle-raising family has benefitted greatly from the fact that part of the comuna's forest remains open-access and unmonitored, and from the lack of local institutions regarding forest use. In the absence of such institutions, the family has seized hundreds of acres. Like the paja farmers and the woodcutters, the outsiders' type of forest use—turning it into pasture—also threatens the forest's survival in the long-term.

Significantly, only a few of the users are aware of the public goods provided by the forest; even fewer value these environmental services highly. Generally, comuna members have little knowledge of how the forest protects their watershed or affects their climate: while local nongovernmental organizations are trying to convince residents of various comunas in this region of the direct link between deforestation and the increasingly dry climate, paja growers and woodcutters do not mention these environmental concerns in discussions about their activities. Consequently, individuals value the forest for consumptive uses. And given the local economy and the rate of forest depletion, these consumptive uses appear unsustainable.

Conclusion

This study of the Loma Alta Forest highlights several issues regarding institutions, forests, and user groups important to policymakers concerned with Ecua-

dor, as well as for scholars and practitioners interested in more general issues relating to the conservation of forests. The Loma Alta Forest shows deforestation rates which, if held constant, would result in total loss of trees on the remaining 950 ha. in the next 25 years. On average over the past 20 years, 10 ha. per year have been converted to paja toquilla and 30 ha. per year to pasture. Maintaining Loma Alta's Forest is crucial to the entire community: loss of the multilayered forest will reduce water input to the groundwater resources of the Loma Alta watershed. With less forest cover, the vegetative surface area for intercepting moisture from the air is reduced, local evaporation is increased, and less water percolates down to aquifers. Both rainfall data and local memory confirm that Loma Alta's prolonged drought parallels the rate of deforestation, causing scientists, some officials, and locals to think the phenomena are closely related.

Despite the importance of the forest to the entire comuna, this study has shown that conceptualizing Loma Alta as a single entity, or viewing the forest as one resource, may not be fruitful methods by which to diagnose the causes of Loma Alta's deforestation. By viewing a forest as a resource that provides a number of different commodities, and by examining the different groups who use these commodities, we provided an explanation for the lack of institutions regulating Loma Alta's Forest. While the comuna possesses most of the institutional assets that would favor the development of institutions, it has not yet created any rules regarding forest use. We found that those members with the biggest economic stake in the forest have no reason to limit their exploitative practices, and thus little demand exists for forest regulation at the local level. This lack of forestry institutions has led to an outcome whereby Loma Alta's Forest, while having some areas of relatively good secondary growth, is in danger of being more severely degraded in the near future.

Although no forest institutions exist in Loma Alta, we found that rules have had a direct impact on the forest's condition. The comuna's property-rights institutions, for example, provided a partial explanation for the pattern of forest use and current forest condition. As predicted by most property-rights theorists, the comuna reserve—that part of the forest without individual landholders—is the most seriously degraded (Demsetz, 1967; Libecap, 1989; North, 1990). Landholders, nonlandholders, and even noncomuna members choose to cut trees in the reserve first when they seek timber. Those plots with individual landholders, on the other hand, contain areas with less forest exploitation.

The Loma Alta case also demonstrates that strong individual property rights alone do not guarantee a forest's health. Landholders in Loma Alta possess incentives that do not favor the forest's long-term sustainability. Paja toquilla farmers would choose to expand their holdings of paja—which generates a certain and rela-

tively long-term stream of income—over preserving the forest. Similarly, woodcutters only earn income with the removal of trees; even though their livelihood depends on some minimum population of trees, their short time horizons favor the complete removal of the trees before they consider a shift to other occupations.

To prevent continued deforestation in the Loma Alta area, policymakers must address the incentives that drive the behaviors of those users most crucial to the forest's existence, *viz-* the farmers of paja toquilla, the woodcutters, and the outside invaders. Only when these actors consider alternative, less destructive activities to be of greater value than their present, more destructive practices, will the forest's exploitation be limited. Part of the task confronting those interested in the long-term survival of the forest is to link comuna members' perceptions of the forest with its provision of public goods. If the forest's effects on the watershed and weather were more widely understood, locals may be more willing to support an institution that manages the forest's use.

Even if most comuna members highly valued the forest's public goods, however, there still remains a collective-action problem in the supply of institutions, e.g., although everyone benefits from the forest, it is an individual's interest to free-ride on the contributions of others (Olson, 1965; Ostrom, 1990). Given that no individual or small group in Loma Alta appears desirous of bearing the costs of starting a management institution, there may exist a role for nongovernment or government organization to cover such start-up expenses (Thomson, 1992).

While considerable challenges confront those who wish to limit or stop Loma Alta's deforestation, the comuna possesses significant advantages over other rural areas. First, the population of the Loma Alta comuna is roughly stable. Approximately half of the young adults are leaving the area to pursue better employment opportunities in coastal urban areas. The lack of population growth means that the pressure for farm land and timber may not increase rapidly in the near future. Second, the institutional assets of Loma Alta, discussed in the second part of this chapter, will be valuable to any attempt to construct a local solution to deforestation, despite the fact that the comuna presently has no institutions to regulate the use of their forest (Smale and Ruttan, 1995). The comuna's power to allocate property could be at the center of a policy that attempts to reserve land for watershed protection. The comuna's long history of member participation in committee building could facilitate the construction of monitoring and sanctioning devices as well as assist their staffing by comuna members. Finally, the comuna's experience with intragroup compromise will be critical to discussions that attempt to balance the goals of the comuna as a whole with members who stand to lose benefits if the comuna limits the use of its forest.

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