

IFRI: A Springboard to Tropical Forest Conservation and Co-management in Western Ecuador

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Abstract: This paper contributes to the literature on common forest resources and their collective management. In 1995, an International Forestry Resources and Institutions (IFRI) study was completed in the Comuna of Loma Alta, a rural farming community in western Ecuador. Despite having property rights to a 6,842 hectare watershed, strong local institutions, and value for forest resources, the Comuna had not organized to conserve or protect highland forest, a key resource that provided water for agriculture. Results of the IFRI study provided a foundation for design and implementation of an integrated conservation and development project (ICDP) financed by People Allied for Nature (PAN) and the Earthwatch Institute, two non-profit organizations based in the USA. The IFRI study suggested that a greater understanding of ecosystem services provided by forests might encourage *Comuneros* to protect them. When informed that the forest trapped fog and thus provided water for the lowlands, the Comuna decided to establish a 1000 hectare ecological reserve. Through a co-management agreement, People Allied for Nature financed the demarcation and guarding of the reserve. To assess the impact of these ICDP activities on local knowledge and attitudes, two surveys were conducted. In one survey 41% of the respondents from the Comuna of Loma Alta listed water conservation as the most important role of highland forest, whereas only 5% of peers in an adjacent watershed with no conservation project ranked water conservation as most important. Conservation of water and biodiversity were ranked as more important than employment benefits by 28% of the respondents in Loma Alta. Community members that viewed the President of the Comuna as the rule-maker were less supportive of co-management than those who viewed themselves as rule-makers. According to the survey, participation in demarcation of the reserve was biased towards community members who did not approve of co-management. The IFRI method not only provides useful information for stakeholders in social forestry in Latin America, but can be useful as a springboard or foundation for conservation and development projects.

Key words: Forest conservation, Latin America, conservation and development, NGO, institutions

Introduction

Accomplishing sustainable development and natural resource conservation through decentralization is a dynamic challenge. Not only must national governments and international donor organizations decentralize the allocation of funds and projects, but local communities who may be accustomed to external control of natural resources (Pinkerton 1992) must establish or revive self-governance and make new institutional collaborations (Eccleston 1996, Wainwright & Wehrmeyer 1998). With the shift away from state-centered policies, non-government organizations (NGOs) increasingly play a role in conservation and development (Atack 1999). According to Edwards (1999), making a difference to livelihoods and capacities of local people depends on successes in fostering autonomous grassroots institutions and on linking them with markets and political structures at higher levels. Thus, NGOs are well advised to assess the capacity of local institutions prior to initiating projects.

The International Forestry Resources and Institutions (IFRI) research strategy (Ostrom and Wertime 1995) provides a framework for assessing the institutional capacity of local communities in forest resource stewardship. This paper describes and evaluates a case in which IFRI was used to gather information prior to collaboration between People Allied for Nature (PAN), a conservation NGO, and the Comuna of Loma Alta (the Comuna), a rural community in western Ecuador. Initially, from the point of view of the NGO, the goal of the collaboration was wildlife conservation. Since 1994, the two parties have co-evolved an institutional relationship that has resulted in forest protection via co-management.

In this paper I first review the results and academic interpretations (Becker and Gibson 1995) of the IFRI study completed at the Comuna and explore two questions:

3. Which results from IFRI have facilitated the NGO's interactions with the community?
4. Which results from IFRI were communicated to the community?

Next, I briefly describe the integrated conservation and development projects completed by the NGO and the community and the micro-institutional changes associated with these projects. Thirdly, I report on the results of two surveys conducted in 1997 and 1999 to assess local attitudes toward conservation and co-management of the highland forest reserve. I conclude

with a discussion and summary of the merit of using IFRI methods as a foundation or springboard for integrated conservation and development projects (ICDPs).

Loma Alta, People Allied for Nature, and IFRI

According to their Certificate of Incorporation (Nathan 1994), People Allied for Nature's mission is to facilitate protection of tropical forest for wildlife preservation. PAN is a small NGO with an annual budget less than \$40,000. Since 1994, PAN has directed the majority of its effort at a single site in western Ecuador, the Comuna of Loma Alta¹. About 2,000 people live in the Comuna sharing property rights to a watershed covering 6,842 hectares of land in western Ecuador (Figure 1). About 1650 hectares of the Comuna are in the Colonche Hills, a 95 kilometer coastal mountain range, and were designated as Protective Forest (Bosque Protector) in 1987. To learn more about forest-people relationships in the Bosque Protector, the directors of PAN collaborated with the International Forestry Resources and Institutions (IFRI) research program, an academic research group that collects and analyzes biological and social data about forest use at the micro-level (Ostrom & Wertime 1995).

The Comuna is a theoretically attractive case regarding micro-level causes of deforestation because it has three fundamental preconditions for successful resource management. In the first place, the Comuna has secure property rights and control over forest resources, so they have a stake in the long-term sustainability of the goods and services associated with the forest (McKean 1996, Schlager & Ostrom 1993). Secondly, the Comuna has micro-institutions and a long history of local decision-making about land allocation (Bromley et. al. 1992, Ostrom 1990), so they have the capacity to make rules and regulate forest exploitation. Thirdly, forest resources are used and valued by local people, so they have an incentive to manage forest resources. Thus, the IFRI research goal was to determine whether the comuna was using collective action to sustain its forest resources.

The IFRI study at Loma Alta focused on governance and use of forested lands in the northern portion of the Comuna's watershed, which in 1986 was designated by the national government as "protective forest" or *Bosque Protector* (Becker and Gibson 1995). Ten IFRI

forms (forest, forest plots, settlements, user groups, forest-user group relationships, forest products, site, organizational inventory, forest association, and non-harvesting organization) were completed by research teams using a variety of methods including participatory rural appraisal (PRA), informal interviews, forest visits, and forest sampling (Ostrom & Wertime 1995).

Results of the IFRI Study: A Brief Review

Despite micro-institutions, secure land tenure, and basic values for forest resources, the *comuneros* had not self-organized to sustain the highland forest. Instead, the highland forest was steadily being deforested and degraded. The local land tenure system, respect for individual use rights, and the Comuna's inability to defend communal property all contributed to deforestation (Gibson and Becker, in press). Becker and Gibson (1995) concluded that both land allocation and the diversity of forest users influenced forest condition in the 1650 hectare Bosque Protector where moist tropical forest was the climax plant community. Land allocation in the highlands was fairly egalitarian, restricting individual plot sizes to 10 to 30 hectares. This led to a patchwork of deforestation and degradation that was evenly distributed over the southern 1000 hectares of highland forest.

Farmers and woodcutters, the two groups from the Comuna that used the highland forest most, had conflicting goals, and this was a barrier to collective action for forest protection (Becker and Gibson 1995). Farmers typically obtained usage rights to highland moist forest, cleared 1-5 hectares, and planted Panama hat fiber, *Carludovica palmata*, locally called *paja toquilla*. When interviewed, *Paja* growers said they aimed to expand their fields and thus would not support or make rules that might constrain expansion of their fields². In contrast, woodcutters had an incentive to protect large blocks of forest, but as a minority, would not be able to make a strong case for controlling activities on parcels allocated to others. Besides, the best wood trees had been harvested from the highlands in the 1970's by private timber companies, so organizing a timber reserve would not be a financially viable short-term investment.

¹ To protect the tenure rights of rural families, Ecuador passed the Law of the Comunas in 1936. This law formalized traditional tenure arrangements, many based on using natural watersheds to define the boundaries of communities (Comunas).

² When PAN proposed a protected area, growers of *paja toquilla* were most opposed to it. They were persuaded to support the reserve by lowland farmers, but only agreed under the condition that they could retain *paja* fields at the level of 1996 coverage.

The IFRI study discovered an “indirect” user group. A majority of *comuneros* made their living from irrigated agriculture in the lowlands, yet they had not organized to protect the forest. It was clear that these farmers undervalued the ecosystem services of the forest, especially the role of fog capture by trees in the highlands and their provision of water to the entire watershed (Becker 1999).

IFRI research found that the northern-most 600 hectares of highland forest was held in common, and was “open access”. Few individuals were willing to travel more than 5 kilometers to cultivate or cut timber, so this part of the watershed had not been allocated. About half this area had been converted to pasture by invading ranchers, while the other half remained in a nearly pristine state. The Comuna made several attempts to evict the ranchers, and had even obtained military assistance in 1986-87 to protect their land claim, but the ranchers returned when military guards left the area.

IFRI: A Springboard for Conservation

Like a springboard, the IFRI study provided a foundation to launch PAN and the community into a relationship that would lead to co-management of the highland forest. IFRI facilitated the NGO’s ability to work with the community in several ways. IFRI’s methodical search for any local governance or rules related to forest resources directed the attention of local decision-makers to this void. IFRI facilitated communication at *assembleas* (community meetings) and clarified the leadership style of the *Cabildo* (5 elected leaders). By identifying forest user groups and the incentives they faced, IFRI provided a foundation for PAN’s strategy for appealing to each group. PAN became aware that *paja* growers needed incentives not to expand their fields. Woodcutters would need incentives to regulate or stop timber harvests in the highlands, and ranchers, with no legal right the communal highlands should be evicted.

Since lack of tenure rights and institutional capacity were eliminated as explanatory causes of deforestation at Loma Alta, PAN’s working hypothesis was that *Comuneros* under-valued the ecosystem services of the forest (Becker 1999). This was especially true of lowland farmers with irrigation systems. If these farmers made the connection between the distant forests and their water supply, than a majority of the community would have a stake in forest protection.

What IFRI results were communicated to the Comuna by PAN?

The IFRI study focused community attention on their highland forests. At the start of our study, many of the comuneros we spoke with did not understand the concept of a *Bosque Protector* or protective forest. In 1986, the Cabildo of Loma Alta had obtained government assistance to defend the Comuna boundaries and officially designated the northern 1650 hectares as Bosque Protector. As a result, many people in Loma Alta thought the term Bosque Protector was created to protect their property rights and were not aware that the intended purpose was to sustain the ecological integrity of watersheds in Ecuador (Becker 1999).

PAN's 1995 written report to the Comuna of Loma Alta provided educational material on deforestation in western Ecuador, outlined the ecosystem services provided by highland forests, and explained the rationale behind designating certain forests as Bosque Protector (Becker et al. 1995). The report included a written history of each settlement and a summary of social aspects of the community (Table 1). It also described current forest use and its negative consequences for the forest's ecosystem services, and it clearly stated that such impacts could harm the long-term sustainability of the community. The report congratulated the community on its self-organization, and urged the Comuna to use its institutional and social capital to protect the highland forest. Recommendations were broad and indicated that PAN or other NGO's were available to help the Comuna establish a protected area if they decided that they wanted one (Table 2).

Following the IFRI study in 1995, PAN began a campaign to convince the Comuna to establish a protected area. They paid for an Ecuadorian environmental educator to coordinate an Ecology Club for adults in the community, and helped coordinate research on fog capture in the highlands. A study sponsored by Earthwatch Institute in June and July of 1996 discovered that conversion from forest to pasture in the highlands results in as much as a ten-fold reduction in water input via interception of fog per hectare per year (Becker 1999). When informed of these findings, the *Cabildo* organized a special *asamblea* and invited PAN to present and justify a proposal for a forest reserve before the community. After several *asambleas* where the pros and cons of creating a reserve were debated, a final vote was held and 95% of the 110 adults attending voted in favor of making a forest reserve. On August 24th, 1996 about 1000 hectares of the Bosque Protector were declared as Reserva Ecológica de Loma Alta (Fig. 2). PAN agreed to co-manage the reserve.

Evolution of Co-management

With the foundation of the ecological reserve, co-management became PAN's primary focus, and consumed PAN's supply of non-profit social and financial capital. Co-management was facilitated by a document called the "Convenio de Ayuda Mutua" (agreement of mutual help). In practice, this agreement led to integrated conservation and development. Village-level improvements (additional teachers, medical supplies, water pump, electricity in a school, etc.) typically followed or accompanied a forest conservation effort (Table 3). Employment and training related to forest protection, value-added crafts from non-timber forest products, and reforestation were used to integrate forest conservation with local development.

PAN's resolutions and annual reports from 1994 to 1999 indicate that their goals narrowed from broadly defined wildlife conservation to stewardship of the new protected area at Loma Alta. Over time, a greater proportion of PAN funding was allocated to quality of life issues in the Comuna rather than conservation *per se*. For example PAN provided funds for one village teacher in 1996, three teachers in 1997, and five as of November 1999. Likewise, the Comuna changed the type of requests they made to PAN. Early in the relationship, the Cabildo asked the NGO to assist with funds for their Saints Day Fiesta. Recent requests have been for workshops on value-added products from *Paja Toquilla*, which would reduce the need to expand fields (conserve forest), and help respond to a decline in price for the raw fiber.

Assessing Local Attitudes about the Reserve and Co-Management

Two surveys were conducted to determine the effects of PAN's ICDP work on knowledge and attitudes of comuneros at Loma Alta. Bilingual Earthwatch volunteers completed this first survey in August 1997, entitled, "Local Opinions about Wildlife and Hill Forests". The goal of this survey was to determine if, after exposure to and participation in conservation activities with PAN, people in Loma Alta valued highland forest for its ecosystem services more than people who had not been exposed to environmental education about the forest. Selection of participants in the survey was opportunistic and took place in El Suspiro, a settlement of 60 households in the Comuna of Loma Alta, and in Rio Blanco, a settlement of 28 households located about 15 kilometers to the north of Loma Alta. Both communities use forest resources in the Colonche Hills and share similar socio-economic and cultural backgrounds, but Rio Blanco

had no exposure to PAN's conservation programs. In contrast, El Suspiro had been the focus of PAN's conservation and development efforts for two years.

PAN and the Cabildo of Loma Alta maintain written records of co-management agreements (*convenios*), but it was not clear how widely disseminated this information was in the Comuna. To find out, a second survey, "Local Knowledge, Attitudes, and Perceptions about the Loma Alta Ecological Reserve", was completed in December 1999 at the Comuna of Loma Alta (Appendix II). Questions explored included: Did local people know the rules, the size of the reserve, or exactly where the reserve was located? Did participation in PAN projects influence knowledge and attitudes? Did local people support co-management and the rules of the reserve? To complete this survey, heads of households were selected by convenience from the four settlements in the Comuna, participation was voluntary, and respondents were interviewed by a *comunero* from El Suspiro.

Survey Results

Survey 1: Local Opinions about Wildlife and Hill Forests

Respondents from both communities compiled similar lists of local wildlife. Snakes and big cats were most frequently listed as species that should be less abundant, and some desired fewer monkeys, parrots, squirrels, raccoons, and skunks. Most respondents wished that deer, rabbit, wild pigs, and edible forest rodents were more abundant.

To the question, "Are highland forests important to you and your family?", only one person from Rio Blanco replied "no". Thus, our sample suggests that most rural adults value the highland forest. Although both communities used the highlands for similar reasons, 61% of the respondents (N=18) from Rio Blanco said that forests were mainly important for farming, whereas only 31% of respondents in El Suspiro (N=32) listed farming as important. As predicted, more respondents from El Suspiro (41%) emphasized the importance of ecosystem services, specifically water conservation, than respondents from Rio Blanco (5.5%) (Chi-square = 15.9, d.f. = 1, P < 0.05).

Survey 2: Local Knowledge, Attitudes, and Perceptions about the Loma Alta Ecological Reserve

Sixty-one heads of households (10 women, 51 men) completed the second survey. The average age of the respondents was 40.8 ± 12 years (range = 20 to 75). About half of the

respondents (49%) came from El Suspiro, the village nearest to the highland forest, and the remainder came from the more distant lowland villages of Loma Alta, La Ponga and Union.

All respondents knew approximately when the reserve was established and where the reserve was located, but only 42% knew its correct size (~1000 ha) when given the choice of 100, 1000, or 10,000 hectares. One person said it was an order of magnitude larger, but the majority, 57% thought that the reserve was an order of magnitude smaller (100 ha rather than 1000 ha.). Although villagers from El Suspiro (nearest to the forest) were not more likely to know the correct size than those living in the more distant settlements (Chi-square 2.26, d.f. = 2, $p = .32$), participation in demarcation of the reserve led to more correct answers. Of the 30 respondents who had helped demarcate the reserve, 76% of them knew its correct size, whereas only 10% of non-participants knew the reserve's true size (Chi-square = 27.3, d.f. = 2, $P < 0.001$).

In replies to two open-ended questions about the purpose of the reserve, 57% of the respondents emphasized preservation of biodiversity, 38% listed ecosystem services (water and soil conservation), and the remaining three respondents listed, tourism, science, and defense of property rights. When asked to rank the “most important benefits” of the reserve, 65% of the respondents listed conservation, employment, and land security as equally important. Conservation of soil and water were ranked as the most important benefit by 28%, whereas employment and land security were ranked as most important by less than 5% of the respondents.

Local knowledge about rules in the reserve

Hunting wildlife and cutting trees are not permitted in the reserve, and this information is posted at all major entry points to the reserve. Restrictions or lack of them are known by forest guards and are listed in co-management documents. To test how familiar local people were with rules, respondents read or were read a list of 9 activities for which they were to indicate “permitted” or “not permitted”. Out of a perfect score of 9, the mean of the survey-takers was 6.3 ± 1.9 (N=61), or 70%. Only four of 61 respondents claimed that hunting of wildlife was permitted. Seven were incorrect in stating that tree-cutting was permitted. When presented with “hunt butterflies” as a choice, 12 people said this activity was permitted, showing a lack of consistency in their interpretation of the rule forbidding hunting of wildlife.

The survey collected data on attributes of each respondent that might influence an individual's knowledge of rules for managing the reserve (See Appendix I). These attributes were: 1) the number and intensity of PAN workshops attended (Participation Score), 2) the role the respondent had played in establishing the reserve (Establishment Score), 3) the extent to which a person had helped sustain the reserve (Contribution Score), 4) the number of times the respondent had visited the reserve, 5) their age, and 6) the size of their family. Multiple regression of these six factors suggested that age, extent of participation in PAN workshops (score = 0 to 7), and time on PAN projects were not significant factors (Table 4). Family size and Establishment Score were negatively correlated with knowledge of rules (Table 4). The only positive correlation with knowledge of rules was the number of visits to the reserve ($P = 0.02$). Overall, the six-factor model explained 41.2 % of the variation in knowledge about rules (ANOVA, d.f. = 6, 52, $F = 6$, $P < .0001$).

Local attitudes towards rules and co-management of the reserve

Seven respondents (11%) stated that they were initially opposed to making the reserve. By the time a vote was taken on the issue, four of these had changed over to supporting the reserve. Of those surveyed 38% voted "for" the reserve at the community meeting to decide on the reserve, while the remainder did not attend that meeting. Distance from the voting center in Loma Alta did not influence participation in that particular vote (Chi-squares, $P < .79$), or respondent attitudes towards the reserve (Figure 3; $P < .77$).

According to the survey results, the people who participated in demarcation of the reserve were not its chief supporters (Figure 3). While 52% of respondents had favored making a reserve, only about 25% of this group joined the effort to demarcate the reserve. In contrast, 80% of those remaining respondents who were ambivalent or opposed to the reserve helped mark the boundaries (Chi-Square = 17.3, d.f.=3, $P < 0.001$). Respondents who helped demarcate the reserve averaged 2.3 points lower on knowledge of rules than those who did not help (T-test = 5.66, d.f.=59, $P < 0.01$).

When asked who should manage the reserve, the majority (62%) said that it should be co-managed by PAN and the Comuna. One person said PAN should manage the reserve alone, and 37% felt that only the Comuna should manage the reserve.

All 61 of the respondents stated that they agreed with the rules regulating activities in the reserve. However, the concept of who made the rules varied. One person said they did not know who made the rules, 49% said that the President of the Comuna made the rules, 40.6% said the Comuna made the rules, and 8.4% said that PAN made the rules.

Respondents from the three communities near where the President of the Comuna resided, and where *assembleas* were held, were twice as likely as people from the remote village of El Suspiro to say that the President made the rules (Chi-square = 6.7, d.f.=3, P = .08). Of the El Suspiro respondents, living the farthest from the seat of local government, 67% said the Comuna or PAN made the rules, compared to 42% for respondents living near the seat of local government. Respondents who stated that the President of the Comuna made the rules were likely to be opposed to co-management (they indicated that only the Comuna should manage the reserve), whereas those who thought the Comuna or PAN made the rules supported co-management (Figure 4).

Discussion

The Merit of IFRI to Conservation and Development Efforts

Many scholars and practitioners are interested in the conditions and perceptions that affect local decisions to manage resources communally (Messerschmidt, 1993). The literature on common property resources (CPRs) is extensive and common forest resources (CFR) are somewhat of a specialty within that domain. Latin America is an especially attractive region for CFR studies because rates of deforestation there are the highest in the world, yet it has 57% of the remaining tropical forest (Rodriguez et. al. 1993).

IFRI provides a framework that requires local citizens to reflect on the extent of self-governance over forest use in their communities. This novel exercise can have mutual benefits for researchers, the community, and NGOs aspiring to work with local communities. What IFRI does not provide, nor intend to provide, is anthropological scope. For example, it took many community meetings before the Comuna decided to co-manage a highland forest protected area with PAN, which was somewhat confusing and exasperating to the directors of the NGO. They learned that *Comuneros* expect to debate, be persuaded by peers, and to seek consensus before making a decision – a one time case of majority rule is not sufficient (Becker 1999). Nothing can

replace time to develop relationships among stakeholders in ICDP projects, but having a relationship that was informed by an objective IFRI study proved useful in this case.

Interpretation of Survey Results

Despite several years of conservation projects and environmental education, attitudes towards wildlife remain utilitarian and defensive. Comuneros in Loma Alta had the same values for wildlife as those from Rio Blanco. They wanted more edible wildlife and less wildlife that prey on domestic animals and crops. However, the survey suggests that PAN projects enhanced appreciation for ecosystem services provided by highland forest, especially conservation of water.

Citizens of Loma Alta have a good understanding of why they are co-managing an ecological reserve with an outside entity. The respondents appear to value the reserve for biodiversity and conservation above or equally with its employment opportunities. While those comuneros that favor Presidential authority in the comuna were opposed to PAN having authority in the co-management arrangement, these respondents were uniformly in agreement with the rules of the reserve.

Surprisingly, local knowledge of the rules for the reserve was high but was not strongly influenced by participation in PAN projects, at least according to the scoring system derived from the survey. This result may be the consequence of little variation in the extent of participation in PAN projects. It was also surprising that high involvement with establishment of the reserve did not lead to a better understanding of the rules. However, at the beginning, rules were still being debated, and participation at that point in time may have led to confusion about the rules. Also, the most heavily involved people (demarcators) were actually the ones most opposed to the reserve, so they may have chosen not to know the rules. Since many visits to the reserve reflect a respondent's active participation in PAN projects, the lack of predictive value associated with Participation and Contribution scores is baffling. Perhaps going to the reserve results in repeated interactions with guards who remind locals of the rules, explaining the positive correlation between visits and knowledge of rules.

Given that few adults have more than 4 years of schooling and have little experience with written surveys, incorrect answers about rules may reflect problems with reading and interpreting the survey document. Finally, the comunero administering the survey appears to have selected

people who had participated in many of the PAN projects, so the survey is somewhat biased against seeing an effect of these programs.

Conclusions

While, self-governance can lead to conservation of natural resources (Ostrom 1990) and economic sustainability at a local level (Dunsmore 1998), rural communities in tropical nations do not consistently have the social or economic capital to achieve stewardship of natural resources (Wainwright & Wehrmeyer 1998). Although some indigenous tribes have norms that conserve and enhance tropical forests (Chernala 1989, Becker & Leon 1999), many of these eco-cultural systems have been severely eroded by national and international development policies (Pinkerton 1981, Rodriguez et. al. 1993, Barbosa 1996).

The Loma Alta case demonstrates that an understanding of local institutions and forest user groups provides a useful foundation for an integrated conservation and development effort concerned with forest resources in western Ecuador. With its focus on people and forest relationships, IFRI should be extremely useful to NGOs working on integrating conservation and development in forested regions. While other institutional analysis frameworks directed at forest resources exist (eg. Thomson 1992), the IFRI research methodology provides a flexible format suited for conservation or social forestry projects.

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Table 1. Contents Page of the Report to Comuna Loma Alta (Becker et. al., 1995)

- I. Acknowledgements
- II. Introduction
 - A. Why is there concern about deforestation?
 - B. History of PAN
- III. Objectives of the IFRI study
- IV. Methods
 - A. Selection of forest
 - B. Forest measurements
 - C. Sociological Methods and Results
- V. Population centers in the Comuna
- VI. Histories and socio-economic aspects of settlements
 - A. Loma Alta
 - B. Suspiro
 - C. La Union and La Ponga
- VII. Values and Occupations
- VIII. Forest User Groups
- IX. Threats to the Forest
- X. Biological Findings
 - A. Current Status and Regeneration
 - B. Herbaceous Understory
 - C. Epiphytes and Climbers
 - D. Animals: mammals, birds and other vertebrates
- XI. Should the Comuna be concerned about deforestation?
- XII. Recommendations from PAN to the Comuna
- XIII. References, Tables, Figures,
- XIV. Executive Summary for ICDP Donors

Table 2. Summary of PAN's recommendations to Comuna Loma Alta

1. Develop new institutions with forest conservation as a goal.
2. Make new collaborations with NGOs with forest conservation as a goal.
3. Make a conservation plan for the highland forest.
4. Make rules for use of highland forests and a system of monitoring and sanctioning.
5. Seek best information to make decisions on use of highland forest.
6. Strive to regain control over highland property legally allocated to the Comuna.
7. Reforest communal lands converted to pastures.
8. Consider ecotourism to generate money for forest protection and community development.

Table 3. Chronology and types of PAN projects completed in the Comuna of Loma Alta after the establishment of the Loma Alta Ecological Reserve.

Date	Project	Type
Sept. 1996	Salaries for four reserve guards	Conservation
Sept. 1996	Pan matches funds raised by parents to hire additional teacher in a village	Development
December 1996	Two week forest guard/guide course	Conservation
Fall 1996	Tagua Jewelry Training	Development
January 1997	Teacher and Remedial Education Pgm	Development
1997 – 1999	Salaries for 3 teachers	Development
March 1997	Salaries for four reserve guards	Conservation
April 1997	Conflict resolution with ranchers	Integrated
April 1997	Electricity for La Ponga School	Development
1998	Reforestation & Jobs Pgm	Integrated
1999 – current	Salaries for 5 teachers	Development

Table 4. Multiple regression to determine variables with predictive value for variation in knowledge of rules in the Loma Alta Ecological Reserve. R-squared = 0.412; ANOVA 6,52; F=6.1, P < .0001). Composite variables (scores) result from assigning points to survey results as annotated in Appendix I.

Variable	Mean	Coefficient	T-value	P-value	r² single
1. Participation Score	6.1	.149	1.02	0.31	0.04
2. Contribution Score	3.5	-.248	-1.4	0.16	0.05
3. Age	40.8	.034	1.45	0.15	0.00
4. Family Size	7.4	-.193	-2.4	0.02	0.02
5. Visits to reserve	4	.140	2.4	0.02	0.09
6. Establishment Score	2	-.518	-3.4	0.00	0.24

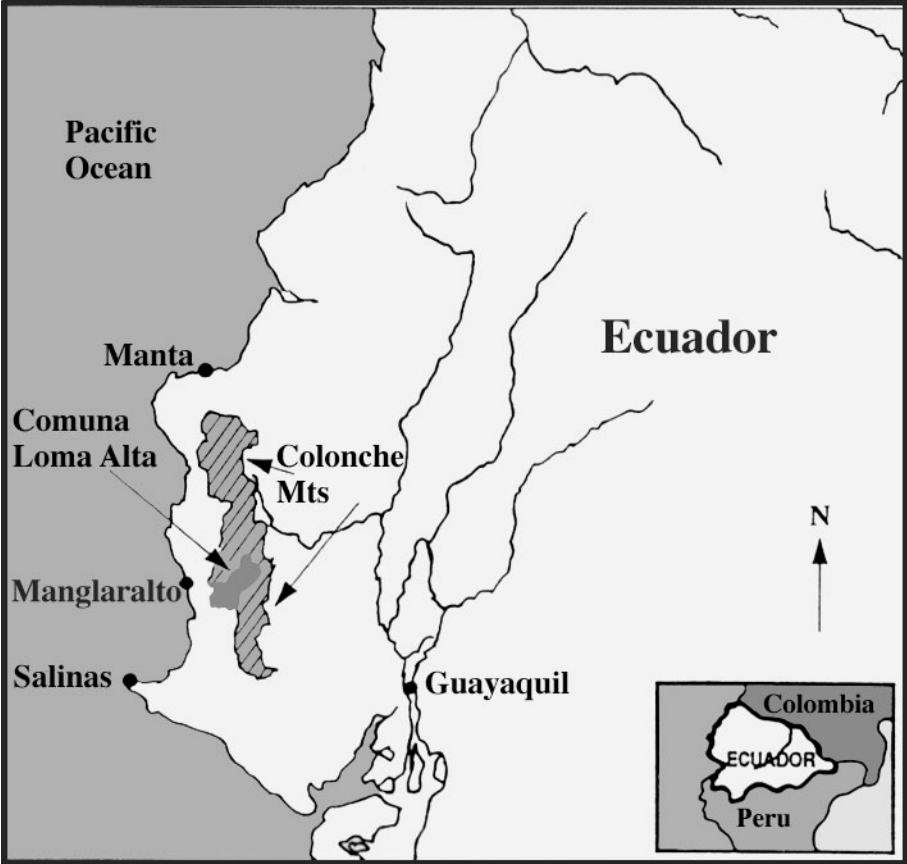


Figure 1. Location of the Comuna Loma Alta in the Colonche Hills of western Ecuador.

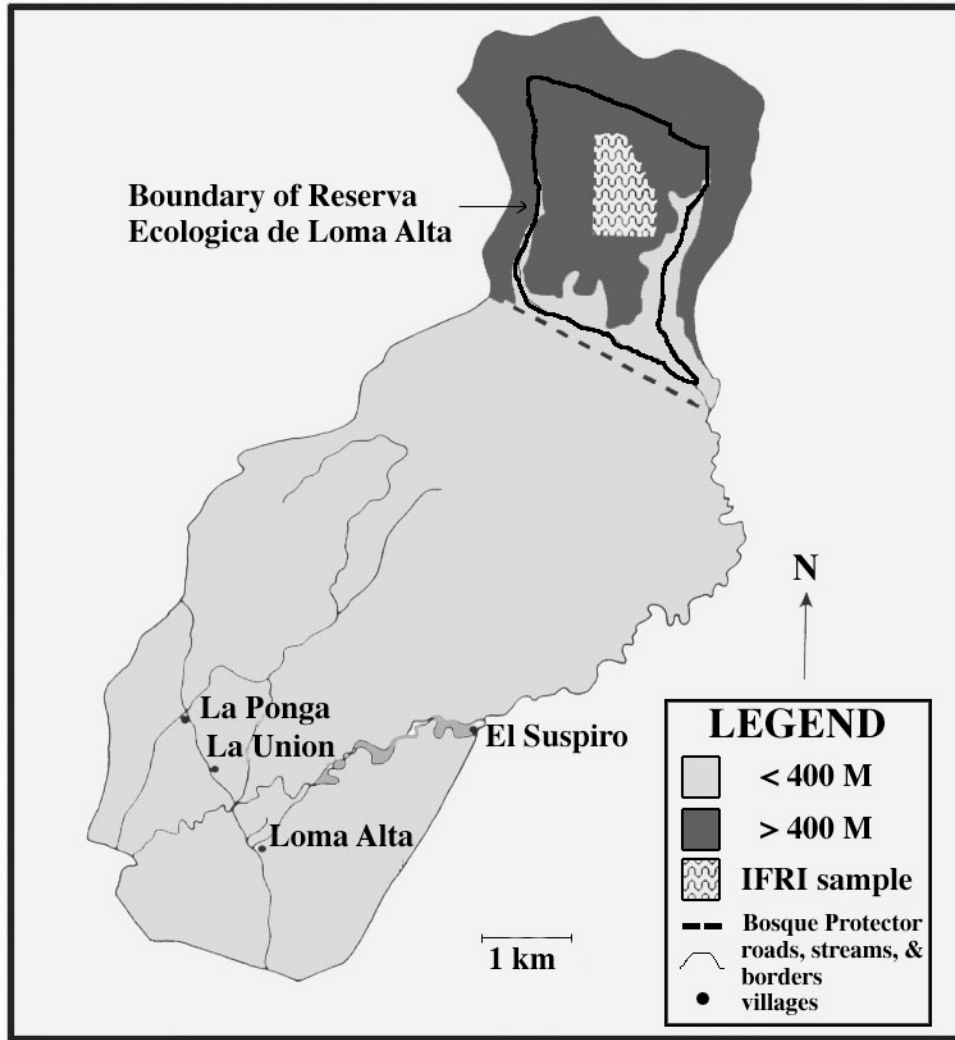


Figure 2. Location of the Loma Alta Ecological Reserve within the boundaries of the Comuna of Loma Alta. Note that the approximately 1000 hectare reserve protects two highland streams that are the major tributaries of the Rio Valdivia, the major water source for all settlements.

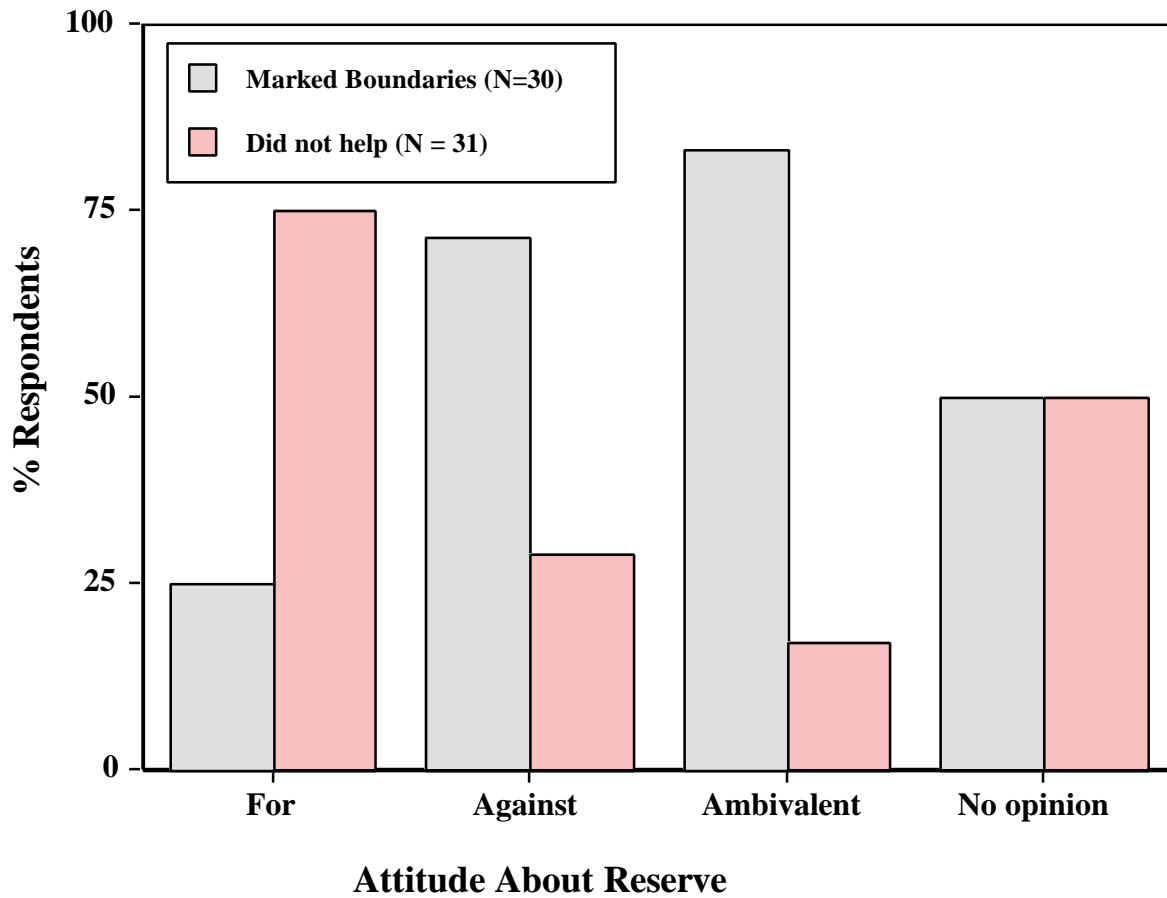


Figure 3. Community members who assisted with demarcation of the reserve were disproportionately represented by people who were either opposed to the reserve or ambiguous about it (Chi-square = 17.3, D. F. = 3, $P < 0.01$).

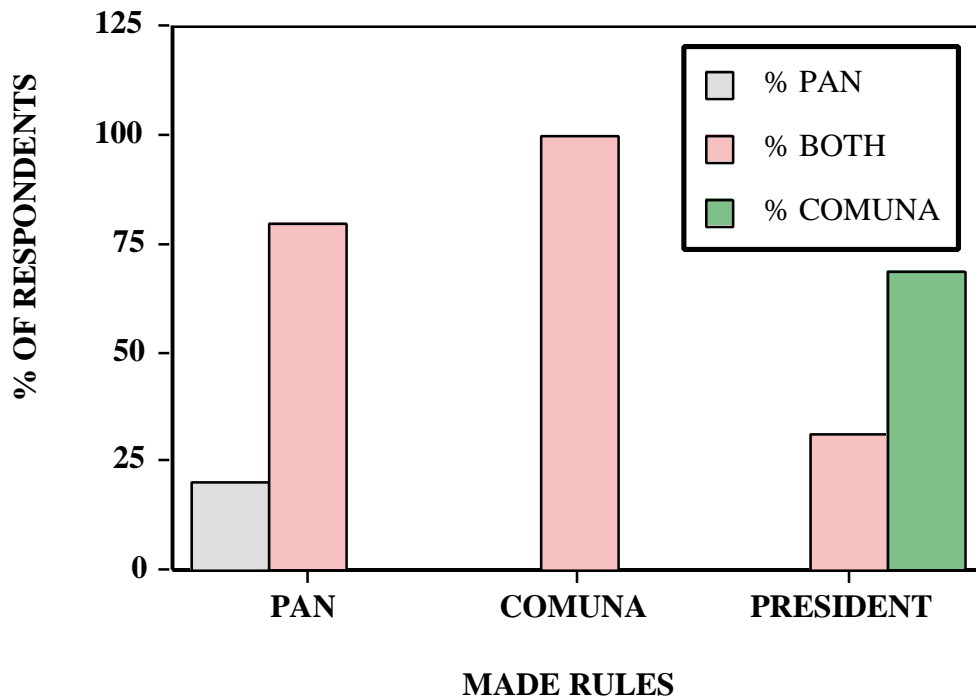


Figure 4. Respondents who viewed the President as the rule maker (N = 29) were more likely to state that PAN should be excluded from management of the reserve. Those who viewed rule-making as a community or PAN directed effort (N=28) were more likely to support co-management (Chi-square = 41.2, d.f. = 6, P < 0.01). One respondent did not know who made the rules, and three did not complete the questions associated with co-management.

Appendix I. Local Knowledge, Attitudes, and Perceptions about the Loma Alta Ecological Reserve. (Composite variables are annotated in italics).

1. What is the Loma Alta Ecological Reserve?
2. Where is this reserve located?
3. How large is the reserve? 100 ha 1000 ha 10,000 ha
4. When was the reserve established?
5. Why was the reserve established?
6. What role did you play in making the reserve? (check all that apply). (*Used to create "Establishment Score"*)
 - I voted in favor of it at the asamblea (2 pts)
 - I helped demarcate it (3 pts)
 - I spoke in favor of it (1 pt)
 - I did not participate in any way 0 pts
 - I was opposed to it (-2 pts)
 - Other: _____ (not applicable as no one added anything)

7. Is the reserve located in the Comuna of Loma Alta? yes no

8. Are there rules or laws in the reserve? yes no

9. What activities are permitted or not permitted in the reserve? (*Used to create "Knowledge of Rules Score"*)

	Permitted	Not Permitted
Hunting of wildlife	_____	_____
Cutting down trees	_____	_____
Expanding Paja fields	_____	_____
Reforestation	_____	_____
Tourism	_____	_____
Harvesting useful forest products	_____	_____
Collecting butterflies	_____	_____
Collecting plants	_____	_____
Working agricultural plots	_____	_____

10. Who made up the rules?

11. Who enforces the rules?

12. Do you agree with all the rules? Why?

13. Have you received any employment or monetary benefits from the existence of the Reserva Ecologica de Loma Alta. yes no
If yes explain: _____

14. Have you participated in any of the workshops offered by PAN? (Circle) (*Workshop Participation Score*)

- a. ecotourism and guide training (1 pt)
- b. guard training (1 pt)
- c. tagua crafts workshop (2 pt)
- d. reforestation project (3 pt)

- e. other: _____ (1 pt)
15. Do you think more workshops should be offered? What kinds?
16. Have your children attended any of the educational programs offered by Earthwatch and PAN?
 ____Yes ____No
17. How does the Reserva Loma Alta benefit you currently?
18. Number the following benefits of the reserve in order of most important (1) to least important (5).
 ___ Collects water from fog
 ___ Prevents soil erosion
 ___ Prevents invasion by ranchers
 ___ Provides employment
 ___ Attracts tourists and researchers who hire comuneros or buy tagua crafts
 ___ Other: _____
19. What part of your annual income in 1999 was derived from activities in the protected forest (guarding, tagua sales to tourists, working when scientists come to do studies in the forest, reforestation, guiding, etc.)?
 a. NONE b. less than 10% c. 10 to 50% d. more than half
20. Have you assisted with the Reserva Ecologica de Loma Alta in any of the following ways? (*Contribution Score derived by giving each activity a value of 1 point*).
 a. Marking its boundaries
 b. Reforestation (planting and watering trees)
 c. Helping with scientific studies
 d. Promoting tourism to the reserve by telling others that it exists
 e. Maintaining trails in the reserve
 f. Visiting the reserve just to see it
21. Circle what you consider appropriate for reserve management:
- | | | | |
|--|-------|---------|----------|
| The Comuna makes all the decisions about how the reserve is managed. | Agree | Neutral | Disagree |
| PAN makes all the decisions for how the reserve is managed. | Agree | Neutral | Disagree |
| The reserve is managed by both the Comuna and PAN with each having an equal say about what can be done in the reserve. | Agree | Neutral | Disagree |
21. How many times have you visited the Reserva Ecologica de Loma Alta in the past year? (*Scale of visitation became 0, 1, 3, 10 for categories respectively*)
 None Once 2-6 times More than 10 times
22. Demographics of "head of household" and their family:
 a. Are you the major decision-maker for your family? Yes No
 b. Who else helps you make decisions? _____
 Village: _____ Age: _____ Gender: _____
 Estimate of annual household income: _____
 Major sources of household income: _____
 Household size (number of people defined as family living together and planning together): _____

