Factors that contribute to cloud forest conservation in southern Ecuador

Pelah Niamie Hoyt

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FACTORS THAT CONTRIBUTE TO CLOUD FOREST
CONSERVATION IN SOUTHERN ECUADOR

by

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presented in partial fulfillment of the requirements
for the degree of

Master of Science

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Date
Tropical montane cloud forests are among the world's most biologically diverse and hydrologically valuable ecosystems, yet they are also among its most threatened. The cloud forest to the south and east of the town of Saraguro in southern Ecuador provide habitat for several endemic and/or threatened animals including the Red-faced Parrot *Hapalopsittaca pyrrhops*, Bearded Guan *Penelope barbata*, Mountain Tapir *Tapirus pinchaque*, and Spectacled Bear *Tremarctos ornatus*. The cloud forests also increase the amount of precipitation that drainages receive and provide water for thousands of urban and rural residents. Most of Saraguro's cloud forests have already been converted to pasture.

The forests are owned almost exclusively by individual indigenous landowners. Despite strong incentives to convert their forest to pasture, some landowners are conserving their forested land. This study seeks to understand why some landowners are conserving their forest.

A complex set of factors was found to contribute to conservation including biophysical limitations to forest conversion, labor scarcity, and others. Higher levels of household wealth and off-farm income allowed farmers the economic freedom to conserve some of their forest. Ecological awareness, especially of the ecosystem services provided by the forest, was also a significant incentive for conservation. The decision by households to conserve forest is part of an ongoing adaptive livelihood strategy that seeks to enhance security and keep options open for the future.

This study illustrates the value of an interdisciplinary approach that examines both the social and ecological components of a specific location. Besides educating locals about the value of cloud forests, conservation efforts need to address their economic needs by reducing poverty and encouraging economic diversification.
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I Introduction

Tropical montane cloud forests are among the world’s most biologically rich and hydrologically valuable ecosystems, yet they are also among its most threatened. The highest concentration of tropical montane forests can be found in Latin America, many of which are located in the tropical Andes (Aldrich et al. 2004).

The North Andes, including Ecuador, contain some of the world’s highest levels of biodiversity and endemism of both plant and animal species (Brown 1987, Prance 1987, Stotz et al. 1996, Whitmore 1998, Luteyen and Churchill 2000, Ridgely and Greenfield 2001b). The northern Andes are just an eighth the size of the Amazon Basin, yet the region is home to an equal number of birds (Stotz et al. 1996), frogs (Lynch et al. 1997), and flowering plants (Luteyen and Churchill 2000). Four to five times as many ferns and mosses live there (Luteyen and Churchill 2000) as well. Of the 640 montane forest birds in the northern Andes, 31% are endemic (Stotz et al. 1996). The diversity and endemism of North Andes forests can be explained in part by the way eco-zones are vertically stacked like a layer cake, with many species being limited to a narrow elevational belt. In addition, climatic symmetry between the western and eastern slopes helps account for the region’s rich array of flora and fauna.

Cloud forests also play a unique hydrologic role because their abundant vegetation intercepts wind driven moisture from clouds. They are distinct from other forest types in that they actually increase the amount of precipitation and annual stream flow within whole drainages (Bruijnzeel and Proctor 1995, Doumenge et al. 1995, Sarmiento 1995, Pounds et al. 1999, Becker 1999, Ataroff and Rada 2000).

Worldwide, tropical montane cloud forests are disappearing at a rate of 1.1% a year – a faster rate of deforestation than in lowland forests (Doumenge et al. 1995). Few tropical Andean forests remain. Several authors suggest that just 10% of the
original forest cover is left (Young 1998, Gade 1999, Luteyen and Churchill 2000) as a result of conversion to agriculture, road construction, timber and firewood harvesting, and hunting (Young 1998, Gade 1999, Luteyen and Churchill 2000). Besides reducing habitat for plant and animal species, deforestation has negatively affected communities by causing firewood shortages, increased erosion and reduced productivity (Morris 1985, White and Maldonado 1991, Southgate and Whitaker 1992, Sarmiento 1995, Keese 1998, Young 1998, Gade 1999). Converting tropical cloud forests to pasture has been shown to reduce water supplies for downstream communities by 5% to 20% (Bruijnzeel and Proctor 1995). Attaroff and Rada (2000) found that downstream communities lost the equivalent of one month of precipitation by converting forest to pasture in the Venezuelan Andes. A study by Becker (1999) in western Ecuador showed that pasture land intercepts up to 10 times less precipitation than cloud forest. Despite the high value and threatened state of tropical Andean forests, research and conservation attention has been focused instead on the tropical forests of the Amazon Basin (Bruijnzeel and Proctor 1995, Sarmiento 1995, Ataroff and Rada 2000, Wunder 2001, Aldrich et al. 2004).

The montane cloud forests of Saraguro in southern Ecuador are no exception to this pattern. The forests around Saraguro were one of five areas of particularly high value in Ecuador identified by the Tropical Montane Forest Initiative (Aldrich et al. 2004) – a collaborative effort by the IUCN (The World Conservation Union), WCMC (World Conservation Monitoring Center), WWF (World Wildlife Fund), and the United Nations. Saraguro forests were recognized as providing exceptionally important habitat for endemic and/or threatened species and for their high socio-economic value in terms of forest products and watershed protection. They provide drinking water for the towns of Saraguro and San Lucas, the city of Loja, and dozens of small
communities in the region. However, the report pointed out that, “the pressures on these forests for fuel and construction wood, and grazing are great” (Aldrich et al. 2004). Saraguro forests provide habitat for the Spectacled Bear *Tremarctos ornatus* and the Mountain Tapir *Tapirus pinchaque* (Belote and Belote 2005). The Spectacled Bear is considered to be vulnerable and the Mountain Tapir endangered by the IUCN Red List of Threatened Species (2004). The Mountain Tapir is one of the most endangered large mammals in the world (Tapir Symposium 2004). As few as 2,500 individuals of this extremely rare animal exist (IUCN 2004).

![Mountain Tapir drawing by Robert A. Wilson 1971.](image)

Saraguro forests also provide important habitat for birds. Saraguro forests are part of the South Central Andes Endemic Bird Area (EBA) which includes the scattered montane cloud forests of southern Ecuador and northernmost Peru (Birdlife International 2003). The following range-restricted species have been identified by Birdlife International in Saraguro forests: Bearded Guan *Penelope barbata*, Red-faced Parrot *Hapalopsittaca pyrrhops*, Rainbow Starfrontlet *Coeligena iris*, and the Purple-throated Sunangel *Heliangelus viola*. Both the Bearded Guan and the Red-faced Parrot are categorized as vulnerable species by the 2004 IUCN Red List (Birdlife
International 2004a, 2004c). The more widespread, but also vulnerable Golden-plumed Parakeet *Leptosittaca branickii* occurs there as well (Birdlife International 2003, 2004b). The South Central Andes EBA, in general, is a high priority for conservation due to major habitat loss in the area, while Saraguro forests, specifically, have been identified as one of 11 key areas for the conservation of these species (Birdlife International 2003). A 1989 study at one of Saraguro's forest remnants recorded 69 bird species, including the threatened species mentioned above and the rare Carunculated Caracara *Phalcoboenus carunculatus*. The study identified the Saraguro forest remnant as having the second highest conservation priority in the entire province of Loja (Bloch et al. 1991).

Saraguro forests are threatened by conversion for agriculture and to a lesser degree by timber and firewood harvesting (Belote 1984, Wunder 1996, Wunder 2000). Saraguro indigenous landowners began converting their forested land to pasture after the construction of the Pan-American highway in the late 1940s (Belote 1984). By the close of the century, most of the forests were gone. The remaining fragments were largely restricted to ridges and mountain tops (Wunder 2000).

![Figure 2. Forests above Saraguro](image-url)
Why do these forest patches remain? What explains the comment that, “a lot of people have stopped cutting, not just us” made by a local landowner? Have these forest remnants been spared largely because they are physically unsuitable for pasture as Belote (1984) suggests? Since the 1970s, the Saraguros have become engaged in a variety of alternative livelihoods (Belote 1984, Belote and Belote 2005). Has this occupational diversification reduced pressure on the remaining forests? This study seeks to understand the factors that contribute to cloud forest conservation on private land to the south and east of the town of Saraguro.

A. Conceptual Approach

The International Forestry Resources and Institutions (IFRI) research program developed by Ostrom and Wertime (1995) and the Adaptive-Renewal Cycle described by Holling (2000) and Berkes et al. (2003) provide a framework for understanding the factors that contribute to cloud forest conservation. The two frameworks overlap in acknowledging the complexity of “social-ecological systems.” Both emphasize the value of understanding the local history of a specific place and criticize other approaches that make generalizations and offer simple solutions to complex problems. Both also call for an interdisciplinary approach to understand resource management that includes an analysis of ecological, economic, and social factors. The IFRI program directs researchers to analyze the role of social institutions and forest product use by local people. The Adaptive Renewal Cycle emphasizes the key importance of different systems of knowledge, world views and ethics as well as livelihood security. Specific attention is paid to the resilience of social-ecological systems and how they remember and adapt to change.
This study builds on the anthropological studies of Saraguro by Linda and Jim Belote (1978, 1984, 2005) and Wunder's (1996, 2001) examination of the causes of deforestation in the province of Loja (where Saraguro is located).

The following questions are highlighted in the IFRI and Adaptive-Renewal frameworks (Ostrom and Wertime 1995, Holling 2000, Berkes et al. 2003) and guide this exploration of factors that contribute to conservation:

- Can biophysical limitations (steepness, elevation and slope) explain the existence of cloud forest fragments?
- How do livelihood issues such as household size, poverty, occupational diversification, and labor scarcity contribute to conservation?
- What role have local and national governments, as well as non-governmental organizations, played in forest conservation?
- How do Saraguro landowners value their forests and how have those values changed over time?
- Do multiple factors influence individual landowner's forest management decisions?

My research grew out of 27 months of participant observation that I conducted while serving as a Peace Corps volunteer in Saraguro. These observations and interviews with 21 key informants shaped the interviews I later did with 60 randomly selected households. Earlier observations and key informant interviews gave me an understanding of the context in which forest management decisions are made and pointed to which factors needed to be explored with participating households. Both qualitative and quantitative methods were used to tease apart the factors that contribute to cloud forest conservation. I will argue that a higher degree of ecological
knowledge/ethics, household wealth, and occupational diversification offer the most powerful explanation for households' decisions to conserve their forest.

**B. Deforestation instead of Degradation**

This study is concerned with deforestation rather than forest degradation. Deforestation is defined as the removal of trees and conversion to another land use. Following the United Nations Food and Agriculture Organization (FAO) criterion, land is considered to be deforested when 10% or less of the tree crown cover remains (FAO 1993). The term forest conversion is used synonymously with deforestation.

Residents have been harvesting firewood and probably many other products from Saraguro forests for at least 1500 years (Ogburn 2001) so all of the forested land around Saraguro is assumed to be degraded to some degree. Despite this long history of use, the forests still provide habitat for a wide variety of animals, including the Mountain Tapir, Spectacled Bear, and Red-faced Parrot. The forests continue to serve a watershed function by intercepting and storing moisture, reducing evapotranspiration, and reducing erosion. Degraded forest also continues to provide firewood and other useful forest products. In contrast, deforested land does not provide good wildlife habitat, watershed protection, or forest products.

Focusing on deforestation should not be taken to mean that degradation is unimportant. Mountain Tapirs, for example, are hunted for medicinal purposes in Saraguro forests. They are important seed dispersers (Olmos 1997) and their removal from the forest could reduce the forest's resilience. Despite the importance of degradation, its degree would be difficult to measure. Since all the forests have been degraded to some degree, a baseline does not exist to compare current levels of degradation against.
II Literature Review

A. Conceptual Approach

B. Factors that Contribute to Conservation
   1. Biophysical Limitations
   2. Population Change
   3. Centrality of Livelihood Issues
   4. Role of Government
   5. Forest Value

A. Conceptual Approach

A number of theories have been used to explain tropical deforestation and conservation including Malthusian arguments that explain deforestation in terms of population pressures, Marxist ones that blame capitalism and the market for forest exploitation, and neo-liberal ones that suggest that capitalism and the market hold the keys to sustainable resource use. These approaches use single factor models to explain deforestation and tend to champion singular solutions such as reducing population growth or allowing the market to produce incentives that ensure sustainable resource use. These simplistic solutions fail to recognize the complexity that is inherent in social-ecological systems. They are not wrong according to Ostrom and Wartime (1995), “they are just too partial.” They point out though, that singular approaches can also be dangerous; because they sometimes prescribe solutions that actually increase deforestation instead of contributing to conservation.

The IFRI research protocol and the Adaptive-Renewal Cycle are valuable, because they recognize that complexity is a defining feature of social-ecological systems (Ostrom and Wartime 1995, Holling 2000, Berkes et al. 2003). Ostrom and Wartime (1995) suggest that, “human uses of forests involve a large number of potentially relevant variables that operate over time with complex feedback loops.”

Not only are social-ecological systems complex; they are also unique and unpredictable. The IFRI and the Adaptive Renewal frameworks both caution against
applying a standardized set of solutions to many places. They emphasize the importance of gathering data about a specific time and location. This is important in the Saraguro context where the socio-ecological system is particularly unusual, as will be seen in the Context section of this paper.

The IFRI and the Adaptive-Renewal approaches call for an interdisciplinary approach that includes both qualitative and quantitative methods for understanding resource use (Ostrom and Wartime 1995, Holling 2000, Berkes et al. 2003). The IFRI research strategy emphasizes the need to understand how the socio-economic, demographic, political, and legal factors influence the sustainability of forest management (Ostrom and Wartime 1995). The IFRI framework is useful for the attention it pays to forest product uses and to the role of social institutions, such as the strength of local governing councils, national government policies, and non-governmental organizations.

The IFRI framework is somewhat inadequate for understanding the Saraguro situation, though, because it focuses so heavily on communally held or state owned land. Most of the land in the Saraguro area is privately owned (Belote 1984). The Adaptive-Renewal framework brings up factors that are useful for understanding private landowner decisions. The work of Holling (2001) and Berkes et al. (2003) is also attractive; because it emphasizes the powerful role of change, resilience, and adaptation, in addition to the centrality of livelihood security. It dovetails nicely with Belote’s (1984) description of changing Saraguro livelihood strategies. Long before the framework was described by Holling and Berkes et al., Belote (1984) discussed its main themes in his exploration of the changing livelihood strategies of the Saraguros, which he referred to as their “Dual-Adaptive Strategy.” Adaptation and resilience are
two themes that guide my historical look at the history of deforestation and conservation in Saraguro.

**B. Factors that Contribute to Conservation**

Much has been written about the factors that contribute to conservation on communally held land in Ecuador (DDA-Suiza and IUCN 1993, Becker 1999, Becker 2001, Wunder 2001). These accounts are largely irrelevant to the Saraguro case, because virtually all of the forested land there is privately owned, with the exception of the communally owned Washapamba Protected Area (Belote 1984). Discussion of conservation on private land has largely centered on the use of conservation easements (Environmental Law Institute 2002, Cesareo and Daly 2004) which have not been used in the Saraguro area.

The IFRI framework (Ostrom and Wartime 1995) and other relevant literature suggest that the following factors may contribute to tropical forest conservation: biophysical limitations, livelihood issues, government policies and regulations, and the ways in which landowners value their forest. Non-governmental organizations have been shown to affect most of these factors. According to Wunder (2000), non-governmental organizations (NGOs) have played a key role in shaping forest management,

Local NGOs, empowered by international funding and technical assistance, have been the most pro-active and consistent agents of forest conservation in Ecuador over the past two decades (p132).

NGOs have provided technical assistance for farmers to increase farm productivity and environmental education which has changed the way landowners value the forest (Cesareo and Daly 2004). In the absence of the governmental influence in rural
areas, NGOs have taken on many traditional government roles; especially by providing extension services (Southgate and Whitaker 1992, Meyer 1993).

1. Biophysical Limitations

Ecological factors such as geology and climate can affect forest management decisions and, in turn, can influence how a location responds ecologically to those decisions. The humidity and elevation of a forested location determines its resilience to human disturbance; with higher and drier sites being less resilient than lower wetter sites (Ellenburg 1979, Young 1998, Gade 1999). A site’s geology can limit a landowner’s management options as well. Forested land cannot be converted to pasture if it is so steep that cows fall off it (White and Maldonado 1991, Wunder 2000). Belote (1984) found that Saraguro landowners did not convert forested land on very steep slopes at higher elevations because pasture grass does not grow well in those locations.

Accessibility, as determined by distance from settlements and roughness of terrain, is another factor that influences forest conservation. Several authors (White and Maldonado 1991, Southgate and Whitaker 1992, Young 1998, Gade 1999) assert that Ecuador’s remaining forests exist largely because of their remoteness and inaccessibility.

Wunder (2000) points out that accessibility may be a less important consideration in cattle production than in timber or firewood extraction, because cattle are a mobile commodity. Cows, he writes, can walk themselves to road heads and that may make forest conversion economical even in distant locations.
2. Population Change

Population growth has been linked to deforestation. Sierra and Stallings (1998) attribute the accelerating rate of deforestation in Emeraldas Province (in Northeast Ecuador) to the 30% increase in population there since 1983. Previous to this time though, Southgate and Whitaker (1994) found that, during the 1970s, deforestation increased in Emeraldas even though the population decreased. This shows that population growth within a small local area cannot always be linked to deforestation.

Wunder (2001) points out that the high rates of deforestation in Ecuador given by the FAO are based on “a statistical model to intra- and extrapolate trends using forest stocks and populations densities as the main explanatory variables” (p96). This model assumes that there is a predictable relationship between population growth and deforestation which means that the high rate of deforestation in Ecuador is model-predicted due to the increase in population. In reality, there is no direct measure of forest loss in Ecuador, although deforestation is certainly occurring (Wunder 2001).

3. Centrality of Livelihood Issues

A landowner’s forest management decisions are influenced by a variety of livelihood issues including, but not limited to, poverty and wealth, occupational diversification, and labor scarcity. Since poverty is so often blamed for forest destruction in Ecuador (White and Maldonado 1991, Southgate and Whitaker 1992), poverty alleviation is a common component of conservation projects (Wunder 2000). Southgate and Whitaker (1992) argue that “the rural poor’s despair” causes deforestation:

Along Andean hillsides ...individuals and families without the skills to land better jobs eke out a marginal living by mining soils, forests, and other renewable resources (p167).
When poverty is viewed as the cause of deforestation, technical assistance to limit poverty through improving agricultural production is frequently seen as the solution. According to this logic, people will have less incentive to convert additional forested land when they can get by on the land they already use (Southgate and Whitaker 1992, Cesareo and Daly 2004). This “full-belly” approach is advocated by White and Maldonado (1991), that is, “concentrate on production and conservation will follow” (p 53).

Wunder (2000) takes a more nuanced view of the role of poverty by pointing out that it has an ambiguous role on forest management. Wunder (1996, 2000) found that poverty can be a disincentive for deforestation when landowners do not have the money to pay for forest clearing. In addition, these poor farmers are often credit constrained and cannot purchase the quantity of cattle that would make clearing worthwhile (Wunder 1996, Wunder 2000). To complicate the discussion, Wunder (2000) acknowledges that a landowner’s economic position can also work in the opposite direction, because large landowners clear their forest at a slower rate than small and medium sized landowners. A study of settlement patterns in the Upano-Palora plain to the east of the Andes shows that the influence of landowner wealth varies from place to place. This study found that large affluent households cleared more land than small poorer families (Rudel 1993). These contradictory findings illustrate the problems associated with applying generalizations about forest management to different places.

In response to authors who propose that increasing agricultural productivity will encourage conservation, Wunder (2000) points out that improved productivity can provide a strong incentive for deforestation by increasing the value of agricultural land. In Brazil, the life of pasture was increased from 5 to 25 years by improved ranching
techniques (Serrao and Toledo 1990). In this case increasing productivity raised the profitability of converting forest to pasture. Cesareo and Daly (2004) suggest that higher prices paid for milk by a new (NGO sponsored) cheese factory might increase cattle grazing in Ecuador’s Condor Bioreserve.

Cesareo and Daly (2004) describe efforts by NGOs to promote alternative livelihoods in an effort to decrease deforestation. NGOs provide micro-credit for small landowners to start tire repair shops, chicken farms, and other small businesses. Occupational diversification could contribute to forest conservation by expanding opportunities for landowners (Southgate and Whitaker 1992, White and Maldonado 1991). In 1984 Belote described how Saraguro landowners were diversifying their livelihood strategy by becoming school teachers, medical doctors, and small business owners; which he suggests could reduce pressure to clear additional forested land. Wunder (1996) concluded that migration to the eastern lowlands reduced incentives to convert new land to pasture in the San Lucas area. Belote (1984) describes a similar phenomenon in the Saraguro parish. Labor shortages can also be important. To the south of the Saraguro region, Wunder (1996) describes how the gold mining bonanza in the Pallanda zone reduced the level of deforestation, because people were so busy looking for gold that no one had time to clear the forest for pasture. Wunder’s (1996) conservation strategy proposes looking for alternative economic activities to reduce the pressure on forests.

Secure land tenure is assumed to contribute to conservation, because insecure property rights have been blamed for much of the deforestation in Ecuador (Southgate and Whitaker 1992). Secure property rights may actually contribute to deforestation in some situations. Wunder (2001) points out that forest conversion requires such a
large labor investment that it only makes sense when people have secure enough property rights to ensure that they will be the ones to benefit from the investment.

4. Role of Government

State policies can contribute to both deforestation and conservation. Agencies within one government may work against each other, with one promoting forest conservation while another agency promotes policies that contribute to deforestation. In Ecuador, one agency provides credit exclusively for increasing cattle production (usually on converted forested land), while another seeks to enforce laws prohibiting the cutting of native forests (Wunder 2000). The southern Ecuador based Fundacion Arco Iris suggests that increased enforcement of the forestry and wildlife laws is an essential component of forest conservation (2003).

The establishment of additional protected areas is frequently pushed as a solution to deforestation (Stotz et al. 1996, Fundacion Arco Iris 2003). Creating additional protected areas may be inadequate for protecting forests in Ecuador because, in many cases, boundaries are not respected by surrounding residents (White and Maldonado 1991, Cesareo and Daly 2004). Ecuador’s legally protected areas have been called “paper parks” because they offer legal protection but do not actually accomplish protection on the ground (Southgate and Whitaker 1992, Rudel 1993, Southgate and Whitaker 1994, Doumenge 1995, Mena 1995, Sarmiento 1995). Ecuador’s parks are chronically understaffed, having an average of just one guard for every 12,000-ha of park land (Southgate and Whitaker 1994). Remote sensing of the forest cover of Podocarpus National Park in the southern highlands reveals considerable clearing within park boundaries since it was established in
According to most of these authors, Ecuadorian government policies and laws do little to contribute to forest conservation.

5. Forest Value

Some authors argue that forests are more likely to be conserved when they are valued appropriately (Pierce and Moran 1995, Becker 1999) and that landowners who benefit from forest products are more likely to conserve their forested land (Gade 1999, Southgate 1999, Wunder 2000). In Ecuador’s Carchi province, a 20-ha forest of arrayan trees (*Myrcianthes* sp.) has been conserved, because the trees’ leaves and fruit have medicinal uses (Gade 1999). On the other hand, highly valued forest products, such as tropical hardwoods, can also provide a powerful incentive to deforest (Sierra and Stallings 1998).

Pearce and Moran (1995) suggest that forests should be more likely to be conserved when people have a more complete knowledge of alternative use values (such as non-timber forest products), indirect use values (e.g. ecosystem services), option values (e.g. future revenue opportunities), and existence values (e.g. spiritual connections to the forest). Becker (1999, 2002) describes how the community of Loma Alta in Ecuador worked to conserve their cloud forest once they learned that the forest secures up to ten times more moisture than pasture. This knowledge had a strong impact on community members, because it helped to explain why the river was drying up and irrigation water was decreasing (Becker 1999, 2002). This knowledge motivated the community to work with an outside organization to establish a protected area (Becker 1999, 2002).
Solely valuing the forest may not be adequate for protecting forests. As Doumenge et al. point out, education about the value of forests is only part of the solution:

It is rare that people living close to forests and often dependent on them for their livelihood are not aware of the importance of forests. A more important constraint is often associated with the inability of local populations to take effective action because of the presence of more powerful socioeconomic factors (1995).

Poor landowners may not have the option of conserving their forest no matter how much they value it.

Knowledge of the value of ecosystem services influences forest management decisions. Wunder (1996) notes that conservation is more likely in areas of Ecuador with a more serious deterioration of the environment – especially where water shortages occur. In his study of forest use in the province of Loja (1996) he recognized that water retention was the service that was most often appreciated by landowners. Some land owners in the higher parts of the province conserved their forest to protect the watershed. Other forest functions though, normally did not play a role in conservation, such as protection from erosion and pollination of plants. In light of these findings, Wunder (1996) advocates for more environmental education.

Cultural values of the forest may also be relevant. In Loja province, Wunder (1996) found that mestizos had a more negative view of the forests and viewed it as a dangerous place “where the devil lives.” The Saraguro indigenous people though had a more positive view of the forest (Wunder 1996). He found that indigenous people generally liked forest plants and animals, but he recognized that they do not have any specific myths or rituals that contribute to conservation (Wunder 1996).
III Context

A. Ecological Setting
   1. Geology and Climate
   2. Forest Characteristics

B. Social Setting
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Ecuador is composed of four distinct regions, each with a unique geology, history, and culture. The country is divided by the Andes Mountains. The humid and sparsely populated land to the east of the mountains is known as the Oriente which literally means the East. The highland region is called the Sierra and it has the longest history of permanent human settlement in Ecuador. The capitol city of Quito is located in the Sierra. The region to the west of the mountains is known as the Costa. This region has experienced high population growth during the last century as its cocoa, banana, pineapple, and shrimp farm industries developed. The fourth region is composed of the Galapagos Islands; located 600 km off the coast. With a population of 12.8 million people squeezed into a country about the size of the state of Nevada, Ecuador is the most densely populated country in South America (World Bank 2004). Ecuador also has a high rate of annual deforestation. According to the FAO 2000 Forest Resource Assessment, Ecuador lost 1.2% of its forest cover between 1990 and 2000 which is the highest rate of deforestation in South America and more than double that of surrounding Andean countries (FAO 2000).
The Saraguro area is located in the highlands of southern Ecuador in the province of Loja.

**A. Ecological Setting**

1. **Geology and Climate**

   The Saraguro forests are situated in a unique geographical area which contributes to the high level of endemism found within the forests. In the central and northern parts of Ecuador, the Andes Mountains form two chains with an inter-Andean
valley running between them; but just north of Saraguro this pattern changes. The mountains become lower so that few peaks reach heights above 3400m. By comparison, in Central and North Ecuador, most peaks fall between 3400m and 4200m, although some are much higher such as Chimborazo Volcano at 6310m (Instituto Geografico Militar Ecuador 1998). As the two chains come together near Saraguro they become narrower and form a highly irregular topography. The mountains are no longer arranged in linear chains, like they are to the north, but are instead jumbled together. Slopes are steep, and flat areas are rare. This configuration continues through southern Ecuador and the northernmost section of Peru; beyond which the mountains rise up to higher elevations, the chains split apart and an interandean valley opens again. The geography of the Saraguro area creates distinct ecological conditions as illustrated by the area’s correspondence to the ranges of several endemic bird species including the Bearded Guan and Flame-throated Sunangel *Heliangelus micraster*.

The town of Saraguro is located on a small bench at an elevation of 2550m. Northwest of town, the land drops dramatically into an arid area with steep canyons. To the east and south of Saraguro, the mountains rise up to the continental divide before dropping down into the Amazon basin. The slopes of these mountains were originally covered with dense cloud forest (Luteyn and Churchill 2000). At the tops of the mountains and plateaus, the forest gives way to moist alpine grasslands called páramo.

This research concerns the cloud forest or Upper Montane Forest (following Luteyn and Churchill’s designation 2000) on the slopes of these mountains. Forests are currently found between about 2800m and 3100m. These cloud forests will be
referred to as the “Saraguro forests” in recognition their ecological, cultural, and historical unity.

The continental divide meanders through the forest to the east and south of the town of Saraguro. The area's weather is influenced by systems coming from both the Pacific Ocean and the Amazon Basin. The resulting weather patterns are highly irregular. Belote (1984) recognized a “triple maxima phenomena” with the highest amount of rainfall occurring during three different months throughout the year. He noted that the months receiving the highest rainfall vary from year to year and that some years have just 2 maxima. The weather pattern is further complicated by the fact that the amount of precipitation fluctuates from year to year — ranging from 450mm in some years up to 900mm in others (Belote 1984). Forest patches in the eastern sectors of the area receive around 1500mm of precipitation annually (Fundacion Arco Iris 2003).

Temperatures are cool, especially higher in the mountains, and range between 6 and 16°C. The average temperature between 1963 and 1983 was 13°C (Herrera and Pinzón 1997). Temperatures vary little throughout the year although windy overcast days are cooler than sunny ones. Overcast days are the norm with clouds settling around the mountains tops and fog creeping up the canyons. Precipitation falls in at least small amounts almost everyday — frequently in the form of a light misty rain called páramo (after the alpine country where it is so common). Heavy rainstorms occur as well. The forested area was described by one group who spent two weeks studying birds there as being “impressively wet” (Bloch et al. 1991). Periods with little or no rain also occur, during which time the forest become quite dry and flammable.

Saraguro forests face a variable climate with high rates of évapotranspiration near the canopy, especially on sunny days. Forest plants must cope with periods of
both high and low precipitation. Solar radiation is intense due to the area’s high
elevation and close proximity to the equator (located at 3.5° south). High exposed
areas are also subject to strong winds.

2. Forest Characteristics

The adaptations of Upper Montane Forest species to their harsh environment
differentiate them from those found in Lower Montane Forests in several ways. Trees
are shorter in stature, reaching heights of just 15m compared to Lower Montane
Forests where trees can reach heights of 40m (Lozano 2002). The canopy becomes
even lower as it nears the treeline. Unlike the multi-leveled forests of the lowlands,
the Upper Montane Forest has a simpler structure with no visible strata (Luteyn and
Churchill 2000). Trunks are rarely straight and become more twisted and contorted as
elevation increases. Crowns are compact and dense with trees becoming shrubby at
tree-line. Tree leaves are generally smaller and darker in color than those in lower
montane forests. They typically have hard thick cuticles to protect against the effects
of cold, intense sunlight, and high winds (Luteyn and Churchill 2000). Trees are
heavily laden with mosses, bromeliads, orchids and other epiphytes. The forest has a
closed-in feel. The diurnal temperature fluctuation is small because of the density of
the vegetation, high humidity, and the frequency of low clouds. Due to the cold
temperatures decomposition is slow. The forest floor is buried up to a meter deep in a
thick tangle of roots, dead leaves, limbs, and epiphytes. As Belote and Belote (2005)
point out, the extremely dense vegetation and steep terrain “make this one of the
world’s most difficult areas to travel off-trail. It can easily take several hours to
bushwhack only a mile”.


Steep slopes and high humidity cause frequent landslides. They constitute the dominant form of natural disturbance in Upper Montane Forests (Jørgensen and León-Yánez 1999). A rare clear day affords a view of hillsides slashed with eroded bare earth where the forest has fallen away. This slash marks are locally known as “tiger scratches”. Mountains slopes are a mosaic of vegetation in various stages of regeneration from landslides.

Plant diversity in these forests is high.¹ Inventories of two cloud forests just to the south of Saraguro, but at a similar elevation, recorded 75 and 90 different tree species per hectare respectively (Madsen and Øllgaard 1994). Tall tree ferns *Cyathea* are common and their prehistoric look makes it seem as if a dinosaur just might be lurking up ahead. *Chusquea* bamboo crowds openings, trails, and the tree line. The following tree genera dominate the Saraguro forests: *Clusia* (Guttiferae), *Weinmannia* (Cunoniaceae), *Schefflera* (Araliaceae), *Vallea* (Elaeocarpaceae), *Myrica* (Mirtaceae), *Myrcianthes* (Myrtaceae), *Drimys* (Winteraceae), along with many genera belonging to the families Melastomataceae and Compositaceae. Huge individuals of Ecuador’s native conifer *Podocarpus*, with diameters of two meters, can still be found in Saraguro forests. Large *Podocarpus montanus* and *Podocarpus oleifolius* are estimated to be about 500 years old.

Large individual trees are like an entire ecosystem, since they support such a great diversity of epiphytes and accompanying animals such as frogs, hummingbirds, flycatchers and woodcreepers.

¹ In this paper, plants will usually be identified only to the level of genus. This is due, in part, to my lack of botanical skill, but also the extremely high floral diversity of the forests. Identification to only the level of genera is common for forest plants in the Andes. Gentry’s (1996) authoritative guide of the region’s woody species, for example, only identifies plants to this level. His classification of Andean plants is followed throughout except where noted.
Trees of all sizes are covered with a luxuriant growth of epiphytes that include bryophytes (liverworts and mosses), lichens, filmy ferns, and vascular epiphytes such as bromeliads and orchids. Epiphytes are so numerous that they are considered to be a defining characteristic of Upper Montane Forests. Luteyn and Churchill (2000) recognize epiphytes as the “dominant form of life” there. Epiphytes provide nectar, fruit, and seeds for an assortment of insects, birds, and mammals as well as habitat for nest sites (Nadkarni and Matelson 1989). Bromeliads provide habitat for insects and small bacteria (Sanchez 2002). Their cuplike shape holds small pools of water where frogs lay their eggs (Kricher 1997). On just 39 trees in one hectare of cloud forest at Cajanuma (an area just south of Saraguro with a very similar forest) Bohg (1992) identified 138 different species of vascular epiphytes. The most common epiphytic families there were Orchidaceae, Bromeliaceae, and Hymenophyllaceae. The Andean forests of Ecuador, Columbia, and Peru are the world’s center for orchid
diversity (Gentry 1996). Orchids belonging to the subtribe *Pleurothallidinae* are the most common in Upper Montane Forests (Sanchez 2002).

![Image of orchids](image1)

![Image of orchids](image2)

**Figure 5.** A couple of *Pleurothallidinae* orchids from the Saraguro Forests.

*Anthurium* (Araceae) is a common woody epiphyte with aerial roots that resemble vines and elongated clusters of fruit that are eaten and dispersed by birds and other animals (Loján 2003).

Virtually all of the epiphytes in montane forests, and many of the trees, are animal pollinated (Luteyn and Churchill 2000). Hummingbirds are important pollinators. Like orchids, hummingbirds reach their highest diversity in northwestern
South America and are especially numerous in the Ecuadorian Andes (Ridgely and Greenfield 2001b). Fourteen species of hummingbirds were identified in Saraguro forests (including four endemic species), and many more species are likely to occur there (Ridgely and Greenfield 2001a). The parasitic shrub *Tristerix* (Loranthaceae) imbeds its roots in trees (Jørgensen and León-Yánez 1999), and its clusters of elongated bright red and yellow flowers are a favorite of hummingbirds.

Tanagers, guans, parrots, toucans, trogons, Spectacled Bears (Bear Specialist Group 1996), and Mountain Tapirs (Brooks et al. 1997) feed on fruits in the forest and some are important seed dispersers for many trees and epiphytes. The Mountain Tapir, in particular, may play a critical role in structuring cloud forests (Olmos 1997). In Sangay National Park in central Ecuador, researchers were able to propagate seeds found in tapir feces from 86 different species (Downer 1996).

Saraguro forest predators include falcons, hawks, eagles, possum, the Long-tailed Weasel *Mustela frenata*, and the Andean Fox *Dusicyon culpaeus*. Ninety-five percent of the Spectacled Bear’s diet is composed of plant material, although they occasionally eat small rodents (Jarrin 2001). The Puma or Mountain Lion *Puma concolor* is the top predator in Saraguro forests. Small birds band together, in part, for safety from birds of prey, because the flocks offer more eyes to watch for predators (Thiollay 1999, 2003). They form mixed flocks that include individuals and pairs of tanagers, flycatchers, woodcreepers, ovenbirds, finches and, occasionally, jays.

Montane Cloud Forest vegetation provides a watershed function that increases annual precipitation and is crucial for maintaining stream flow (Bruijnzeel and Proctor 1995, Doumenge et al. 1995, Becker 1999, Ataroff and Rada 2000, Aldrich et al. 2004). Epiphytes play an important role in capturing moisture from mist and fog. Moss sucks up water from the clouds like a sponge. If you take a handful of moss
from a tree and squeeze it, water pours out. Bromeliads also capture and store water in their cistern-like structure. Epiphytes hold so much water in Saraguro forests that on sunny days trees glisten as if they were lit up by Christmas lights.

B. Social Setting

1. Overview of the Current Social Setting

The Saraguro forests are located within two counties – Loja County on the east side of the continental divide and Saraguro County on the western side of the divide. The largest towns within the vicinity of the forests are Saraguro with 3124 residents and 30-45 minutes\(^2\) to the south by bus the much smaller San Lucas with 519 residents (INEC 2001). All but a few residents of the town of San Lucas are indigenous, but most of the residents of the town of Saraguro are non-indigenous people who are descended from the Spanish and usually identify themselves as “white”.\(^3\) Most of the owners of the Saraguro forests live in the Saraguro parish and San Lucas parish. The term “Saraguro” therefore refers to an indigenous group, a county, a parish, a town, and a forested area. The following table clarifies the numerous definitions of the term “Saraguro”.

<table>
<thead>
<tr>
<th>Definitions of the term “Saraguro”</th>
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<tbody>
<tr>
<td>Indigenous group</td>
</tr>
<tr>
<td>County</td>
</tr>
<tr>
<td>Parish</td>
</tr>
<tr>
<td>Town</td>
</tr>
<tr>
<td>Forest</td>
</tr>
</tbody>
</table>

\(^2\) Distances are given in terms of how long it takes to get to the place by bus or foot. Forest owners do most of their traveling by bus or foot, so this is the measure of distance that is the most relevant to them. Access to an area that is 5 km away, for example, depends entirely on whether or is accessible by bus or just on foot.

\(^3\) Most identify themselves as being “white”, although some now refer to themselves as “mestizos” in recognition of the mixing of races that has occurred in Ecuador. Throughout this paper I will refer to them as either non-indigenous people or white people.
The city of Loja is located one and a half hours bus ride to the south the town of Saraguro and serves as the capitol of the province of Loja. The city of Cuenca is located between 3 ½ - 4 hours by bus to the north of Saraguro and is the 3rd largest city in Ecuador.

The town of Saraguro is economically and politically more influential than the town San Lucas. Both towns of Saraguro and San Lucas are surrounded by small, mostly indigenous communities. White communities are also present, but are located in the lower sections of both parishes. The indigenous communities are typically in the upper parts of the parishes. The communities have between 150 and 200 households on average. They are legally recognized political entities and each elects its own community governing council called a cabildo.
The majority of the land in the upland areas is privately owned by indigenous individuals. Communities rarely own land communally with the exception of Washapamba (a largely forested area with a small amount of pasture) which is jointly owned by three indigenous communities (Belote 1984).

The indigenous people are called “Saraguros” and they, along with the Otavalos in the north, are the most successful indigenous groups in Ecuador. The Saraguros are unusual in Ecuador in that they own larger amounts and more productive land than whites in the area and than rural residents throughout the highlands of Ecuador (Belote 1984). Belote (1984) describes the Saraguros as being independent, self-sufficient people who owe work to no-one. Saraguros practice a dual livelihood strategy with a strong subsistence base that is complimented by cash market involvement with cows (Belote 1984). Saraguros grow crops close to settlements and raise cattle on formerly forested land that has been cleared for pasture and is generally more distant from and higher than settlements.

Through the 1970s, Belote (1984) found that most households owned 15-30 ha of land (although a small number owned less or no land). He estimated that 40% to 70% of that land was being used for pasture and 40% remained in forest or brush. Some households also owned land that they colonized in the Oriente.

Belote (1984) suggests that the abundance of forested land in the 1970s indicated that population pressure was still not intense – otherwise more of the forested land would have been cleared. Later, population growth started catching up with land availability. Wunder (1996) concludes that, since Belote’s study, the average size of landholdings had shrunk considerably. According to Wunder (1996) the size of the majority (63.9%) of landholdings is three hectares or less.
<table>
<thead>
<tr>
<th>Size of Individual Indigenous Landholdings: Saraguro, San Lucas</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3 ha</td>
</tr>
<tr>
<td>63.9%</td>
</tr>
</tbody>
</table>

Table 1. Size of landholdings (Wunder 1996)

By 1984, Belote suggests that most of the suitable forested land had already been converted to pasture. Conversion to pasture was the primary cause of deforestation around Saraguro (Belote 1984). A large majority of the clearing occurred after the Pan-American Highway was constructed through the area in the late 1940s which connected the area to growing urban markets (Belote 1984).

2. History of Deforestation

Saraguro forests were cleared and degraded long before the Pan-American Highway was completed. Humans have a long history in the tropical Andes in general (Gade 1999) and in the Saraguro area specifically (Temme 1982, Belote 1984, Ogburn 2001). They have had a profound impact on Saraguro forest distribution (Belote 1984, Wunder 2000). Forest cover was reduced by intentional burning for range improvement and extension and by clearing for agriculture, pasture, roads, and settlements. Forests are likely to have been degraded by 1500 years of forest product extraction and hunting. Earlier researchers such as Troll (1959, 1968) suggested a natural causation for the patchiness of pre-colonial forest distribution. In contrast, my research is based on the view, asserted by Gade (1999) and others (Ellenberg 1979, Young 1998), that forest distribution is the result of anthropomorphic transformation:

One now starts with the assumption that the Andean highlands were covered with montane forest and the remaining wooded areas are understood to be the result of habitat fragmentation (Gade 1999, p 48).

This section explores the history of deforestation in the Saraguro area and uncovers the roots of some of the social factors that currently contribute to conservation such as
sacred geography, livelihood strategies, land tenure arrangements, occupational
diversification, the Indian Identity Movement, and international development by NGOs.

a. Pre-history

The earliest residents of Saraguro forests were probably hunters and gatherers
who lived in the páramo starting about 10,000 years ago (Ogburn 2001). As Belote
(1984) points out, food resources would have been more accessible and abundant in
the páramo than in the denser forests. Young (1998) and Gade (1999) describe a
similar scenario in the highlands of Peru, Bolivia, and other parts of Ecuador.
Evidence of stone tool manufacturing and possible encampments was found at
several páramo sites to the north of Saraguro (Temme 1982). These early occupants
probably initiated the first phase of deforestation when they burned the páramo and
treeline vegetation to improve and increase rangeland (Belote 1984, Ogburn 2001),
like early residents did in other parts of the Central Andes (Ellenberg 1979, Gade
1999). Their activities probably increased the extent of the páramo in southern
Ecuador (Ellenberg 1979). Grasslands expanded into previously forested areas
because the harsh growing conditions – cold temperatures and frequent wind – made
forest regeneration slow to recover from human disturbance. Pre-Hispanic occupants
likely grazed camelids in the páramo above Saraguro (Ogburn 2001). Since the
Spanish Conquest, the páramo has been regularly grazed and burned for cattle
(Belote 1984). It is unlikely that deforestation has not occurred during the 10,000
years of human use of the alpine zone.
<table>
<thead>
<tr>
<th>Time Period</th>
<th>Period</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000 - 3250 BC</td>
<td>Pre-ceramic</td>
<td>Burning tree-line vegetation to increase páramo rangeland for wild animals</td>
</tr>
<tr>
<td>500 AD - 1460 AD</td>
<td>Pre-Incan</td>
<td>Clearing for agriculture and settlements between 2900m-2320m</td>
</tr>
<tr>
<td>1460 - 1532 AD</td>
<td>Incan</td>
<td>Possible aorestation as hilltop settlements were abandoned.</td>
</tr>
<tr>
<td>1540s? - late 1940s</td>
<td>Colonial and Independence</td>
<td>Initially, possible aorestation due to the steep drop in population. Later, burning tree-line vegetation near the páramo to expand range for cattle.</td>
</tr>
<tr>
<td>Late 1940s - 1970</td>
<td>Modern</td>
<td>Large-scale forest conversion to pasture after the construction of the Pan-American Highway</td>
</tr>
<tr>
<td>1970 to Present</td>
<td>Diversification</td>
<td>Slowing rate of deforestation and some conservation</td>
</tr>
</tbody>
</table>

*Forest products, especially firewood, were probably harvested throughout the 12,000 year period.


According to the archaeologist Dennis Ogburn, the Saraguro area likely remained heavily forested until 1500 years ago (personal communication 2004). The second phase of deforestation opens 1500 years ago when humans began practicing agriculture in lower areas and establishing permanents settlements on low hilltops (Ogburn 2001). Permanent settlements were established later in Saraguro than in other areas of the Andes, possibly because the region was thickly forested, colder, wetter, and had less flat ground than adjacent areas (Ogburn 2001). Ogburn found large numbers of pre-Incan axes around Saraguro that he believes were probably used to clear forested areas for agriculture settlements (personal communication, 2004). Evidence of fortified hilltop settlements with large numbers of weapons suggests a time of increasing warfare (Ogburn 2001) during this period of deforestation. The remains of terraces built by pre-Incan inhabitants can be clearly seen on hilltops throughout the Saraguro area today.
Forests began to grow back on the hills after the Incas conquered the area in the 1460s. Ogburn (2001) found evidence suggesting that the Incas forced inhabitants to abandon their hilltops settlements and probably relocated them to other parts of the empire (Ogburn 2001, D’Altroy 2002). The Incas established two new settlements that served as administrative centers instead of occupying the abandoned hilltop settlements. Forest returned to the abandoned hilltops. These settlements and terraces were only rediscovered in the late 1940s during the period widespread deforestation that followed the construction of the Pan-American Highway. The following photo of Ramos hill illustrates this two-phased history of deforestation.

Figure 7. Terraces on Ramos hill indicate Pre-Incan forest clearing.

The terraces on this hilltop (and artifacts found there) indicate that the forest was cleared during pre-Incan times. The forest later grew back so that, according to one informant, the hill was completely covered with forest when he was young in the 1950s. The area was cleared again during the modern phase of deforestation.
There is no evidence to suggest that widespread deforestation occurred during Incan times (Ogburn 2001) and it is possible that forest cover began to increase as hilltop settlements were abandoned.

Archeological and ethnographic evidence, as well as oral history, suggest that the ancestors of the Saraguro indigenous people were loyal subjects brought into the area by the Incas from as far away as Lake Titicaca and Cuzco in Bolivia and Peru (Belote 1984, Ogburn 2001). They were likely brought in to administer the newly conquered area, raise camelids, and guard the royal road that went through the area and connected the Empire’s two most important cities Cuzco, Peru and Tomepamba (currently called Cuenca) in Ecuador (Ogburn 2001). Administration of the area would also have involved organizing worship of the area’s sacred geography.

Since pre-Incan times, certain features of Saraguro’s landscape have held spiritual significance (Ogburn 2001) and some are still considered sacred by Saraguros today (Belote 1984, Landívar 1996, personal observation). The region’s sacred geography includes mountains, a waterfall, lakes, streams, and caves (Ogburn 2001). Some of these are located within the Saraguro forests and their cultural significance may contribute to the forests’ conservation. The Incas used the term waka to describe sacred features of the landscape or other unique things. A waka “is any thing or place that had transcendent power (p 142)” and it is a tradition that probably had its roots in earlier Andean beliefs (D’Altroy 2002). Saraguros today still refer to the wakas that inhabit sacred locations and ceremonial events are still practiced at some of these locations (?Belote 1984, Belote and Belote 2005, personal observation).

Ogburn (2001) describes how sacred sites were co-opted by successive conquering groups in the Saraguro area. Archaeological evidence suggests that the
mountain of Puglla that rises above the town of Saraguro may have been a pre-Incan sacred site that was appropriated by the Incans when they then took over the region. After the Spanish Conquest, priests attempted to crush native customs by erecting a cross on top of the mountain. Ogburn’s (2001) translation of the priest’s 1773 account of erecting the cross illustrates the power of the region’s sacred geography:

I remember with singular pleasure a large cross that was placed in a very steep and open mountain of Saraguro. After the very wearying placement of the cross, we were given great comfort, not only by the sight of the exalted timbers on that barbarous height, but much more by the fruit that they produced, which was the end of a superstition that had existed.

From the top of the mountain descended, or came off, a spring or small stream that the Indians called Cusi Yacu, which means “water of happiness”. There the Indians would come, according to their old pagan customs, to make their prophecies and predictions. Since seeing the cross there, they started to call the stream Agua Santa (Holy Water), and attributing to its virtues the results that were hoped for, the superstition was abolished, and they derived from this the veneration of that sign of well-being (p 151).

To this day, hundreds of Saraguros climb the mountain each May, as part of a Catholic ceremony, to decorate the cross atop that same mountain with flowers (Belote and Belote 2004). Residents still value the water that comes from the Kulky Yaku spring (probably the spring referred to as Cusi Yaku in the text) for its purity (personal observation).

At least three sites within the Saraguro forests continue to hold ritual significance today. They include Ingapirka and the paired mountains of Puglla and Acacana. Ingapirka is an Incan sacred site located on the continental divide (Ogburn 2001). Ogburn (2001) and Belote (1984) suggest that its significance may be connected to the peculiarity of its location. The site is located on a reverse continental divide where the water flowing to the west goes into the Atlantic Ocean and the water flowing to the east eventually goes into the Pacific Ocean. Flowing water was ritually
important to the Incas and they likely would have been aware of the uniqueness of this site.

Archaeological and ethnographic evidence suggests that the mountains Acacana and Puglla were almost certain to have been sites of ceremonial focus in both pre-Incan and Incan times (Ogburn 2001). The concept of duality and paired sacred mountains was widespread in the Andean belief system (Ogburn 2001). Acacana and Puglla are the most prominent and largest mountains in the Saraguro area. One is located on either side of the continental divide. An early chronicler wrote that Acacana was the pacarina or "sacred place of origin" of the pre-Incan people. A rare carved puma face was found on the slopes of Acacana, although it is not clear if the artifact is Incan or pre-Incan (Ogburn 2004, personal communication).

Figure 8. Pre-hispanic carved Puma face on Acacana (photo by Dennis Ogburn).

A mossy, triangular shaped pool on the slopes of Acacana was also enhanced or made by the Incas (Ogburn 2004, personal communication). According to several key informants this pool is still used for ritual cleansings by indigenous Saragueros. According to Belote (1984) Puglla is considered by the Saragueros to be the male mountain and Acacana the female. In 1946 Landívar (1996) described how locals
believed that the two mountains threw balls of gold and silver at each other in an epic battle. The female Acacana won the battle. Gualán (1996) recounts the story of how indigenous people used to offer up their first born child to Acacana. After giving their child to the old woman who lived in a cave in the mountain, the family could expect to find a box of silver waiting as they returned home.

b. Colonial and Independence Period

Spanish conquistadors ended Incan rule in 1532, though Saraguro remained a persistent pocket of resistance through the 1540s and maybe beyond. Ambushes on Spanish travelers were frequent (Ogburn 2001) and may have been aided by the area’s thick forest cover:

That the Saraguros were able to kill many Spaniards was most likely due to the prevalence of forest cover in the region. Only under such circumstances does it seem probable that poorly armed and unmounted Saraguros could have achieved such success (Belote 1984, p97).

The Spanish brought the region under control by at least 1583 and possibly maybe earlier (Ogburn 2001).

Belote (2004) goes on to say that this dense forest cover may help to explain why the indigenous people were able to retain ownership of so much of their land. He points out that in the Andes the Spanish were more attracted to drier unforested lands for establishing haciendas. They did not seem to value Saraguro land for agricultural purposes, nor was it rich in minerals (Belote 1984). The Spanish were not interested in establishing haciendas in the forested areas to the east and south of Saraguro and Belote (1984) points out that there is no evidence of the Spaniards and their descendents, “ever having complete, individual, or private control over large quantities of agricultural or forested land (p 98)” in the Saraguro area. Spaniards did
settle in the Saraguro area and established political control. Their descendents largely maintain political control to this day.

Gade (1999) chronicles how the rate of deforestation in the Andes accelerated after the Conquest as Spaniards established wood-intensive industries such as brick making, bread ovens, mining and smelting. The Incas had established controls on tree cutting in an effort to protect wood supplies, but these were abandoned after the Conquest (Gade 1999). The Spaniards used more wood in housing construction than native residents and introduced indoor heating. Introduced animals – particularly sheep and cows – reduced natural forest regeneration and provided an additional motivation to clear forest for pasture (Gade 1999). The story differs in the Saraguro area, because the Spanish Conquest may have initially led to some forest regeneration. The introduction of European diseases, such as smallpox, reduced Indigenous populations throughout the Andes. As a result of depopulation, forests may have regenerated in Ecuador as agricultural lands were abandoned (Wunder 2000).

The Saraguros are unusual in Ecuador in that they were able to retain control over large quantities of good agricultural lands. Belote (1984) suggests that the following factors may have contributed to this remarkable pattern of land tenure. Not only was the landscape wet, cool, and forested; but the area was also located far from urban centers where hacienda crops could be sold. Wheat was one of the few commercially valuable crops that could be grown in this environment, but its bulk and weight made its cultivation uneconomical. The Spaniards did not let the Saraguros off the hook though. Instead the indigenous people were required to maintain the way station in the town of Saraguro. This was an important way station on the route between Cuenca and Loja. Saraguros were required to feed and house Spanish and
later Ecuadorian government officials and their mounts as they traveled through. They were also in charge of providing postal service. The effort required to maintain the way station, and other forms of tribute demanded by the authorities, were such a heavy burden that the Saraguros were able to successfully argue that they would not be able to fulfill their duties without control of a large land base. Belote (1984) has a legal document from 1718 which establishes secure land tenure for the Saraguros.

The Saraguro’s duty to maintain the way station continued until the late 1940s, when the completion of the first motor vehicle road between Cuenca and Loja ended the need for their services.

On the other side of the divide in the parish of San Lucas, the indigenous Saraguros were also able to maintain control of the majority of the land in the upper parts of the watershed, but in San Lucas they led a different struggle to secure land tenure. After the conquest, the San Lucas parish became a hacienda owned by the white man, Jerónimo Ortega (Criollo 1995).

Indigenous people were required to work on the hacienda 2-3 days for free each week. Criollo (1995) describes how this situation changed when in 1858 the indigenous community organized a trip to the capitol to regain control of their land. Seven indigenous men travelled to the northern capitol city of Quito, by foot and horse, to plead their case to the authorities. Criollo (1995) tells the story of how after six months of waiting, San Lucas residents were excited to find their community

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4 The story of how this area became a hacienda is fascinating, although it may be more myth than fact. As written by Gualán (1996), during colonial times the San Lucas area was inhabited by indigenous people who still maintained their old traditions. They had a custom of offering their first born child to the sacred mountain of Acacana. After offering up their child to the old woman of the mountain they would find a box of silver waiting for them on their way home. The priest did not approve of the custom and prohibited its practice. The indigenous people were so angered that they burned down the church. They then burned their own houses and fled east towards the Oriente. According to the story the priest then took all of their lands for himself to establish a hacienda. The story may have some truth to it. Acacana has long likely been considered a sacred mountain since Pre-Incan times, it has been considered to be feminine, is associated with silver, and making offerings to sacred mountains has a long tradition in the Andes (Ogburn 2001). The story’s description of how the land was returned to the indigenous people is also similar to other accounts.
leader, Jose Suquilanda, who led the trip to Quito, sitting on the steps of the church. After a long legal battle, the indigenous community won their suit against the hacienda owner. The land was redistributed to indigenous families based on how much money and work they had put into the legal battle instead of being distributed evenly among community members (Criollo 1995). Like the indigenous residents of the Saraguro parish on the other side of the continental divide, the indigenous people of San Lucas were pro-active and learned how to work within, and take advantage of, the new legal system of the Spaniards and then the Ecuadorians. This resiliency and ability to adapt will be seen again later in this story.

When the Pan-American Highway was constructed it also passed directly through the San Lucas parish and created similar opportunities for the indigenous people to become engaged in external markets.

During the post-colonial period Saraguros grazed cattle in the páramo, but did not clear forested land on the mountain slopes for pasture. The páramo was burned periodically to improve the range and also probably to expand its size (Belote 1984). This would have resulted in some deforestation, although not significant; because the slopes of the mountains remained largely forested until the completion of the Pan-American Highway (Belote 1984).

c. Modern Period

The completion of the highway in the late 1940s had a profound impact on Saraguro forests and marks the beginning of the modern phase of deforestation. The highway increased the value of pasture by facilitating access to the urban markets of Loja, Cuenca, and beyond (Belote 1984). Meat and cheese became more valuable. Cheese is heavy and perishable so it was not feasible to transport large quantities of
it on the backs of mules to markets outside the area. This all changed when cars could finally transport cheese. Saraguro cheese developed a good reputation in Cuenca and Loja that continues to this day (personal observation). Increased urbanization and higher income levels in the cities at this time also increased demand for meat and dairy products (Wunder 2000).

During this time the Saraguros also adopted a new form of cattle production. Before the modern period, cattle grazed freely in the páramo which was located between three and six hours walk from settlements. There were no fences, animals were not tied up, nor were they tended on a daily basis. This method, according to Belote (1984), was not labor intensive, but it did have several disadvantages. The cold temperatures and harsh climate of the high country compromised the animals' health. Being far away from human settlement increased the risk of predation and rustling. In addition dairy products were not marketable because of the great distance to settlements. Beginning around the turn of the century, a small number of households began changing their ranching practices to address these disadvantages. This happened on a small scale until the road came through; thereby providing incentives to increase cattle production and relieving the Saraguros of the “onerous burden” of maintaining the way station (Belote 1984).

Saraguros brought their cows down from the páramo and began clearing forested land for pasture. They also began tethering their animals. This required owners to move the animals daily to water and new grass. Owners walked up to their pastures every day or lived with their cows in the cerro (mountains). They made soft cheese while tending their animals. The cheese became an important part of household diet and several tons of it were sold every week to buyers from urban centers – particularly Loja and Cuenca (Belote 1984).
Saraguro families typically have more than one parcel of land located in different areas (Belote 1984, Criollo 1995). In the 1970s Belote (1984) found that households owned between 5 and fifteen plots of land in different locations. Olson (2005) found that in 2004 landowners had between 2 and 10 parcels of land. Belote (1984) attributed this pattern of fragmentation to inheritance. He suggests that having land in several different places may also contribute to livelihood security in a place with such variable weather.

Following the opening of the Pan American highway, the Saraguros adopted what Belote (1984) calls a “dual-adaptive strategy” that maximized livelihood security. It was based on subsistence agriculture (corn, beans, and potatoes) and selling beef-on-the-hoof and cheese for cash,

As much as they became engaged in the market, however, the Saraguros did not neglect their subsistence orientation; subsistence security was a primary goal of the dual strategy not a mere appendage to the livestock business. Though the small scale livestock raising produced reasonably good long term cash yields by Third World standards, year to year variations in income were great – due to fluctuation in herd sizes and market conditions. A strong subsistence
base, then, freed the Saraguros from the worst features of market engagement (Belote 1984, p 308).

This dual system of “corn and cattle” (Belote 1984) remains important to the Saraguro livelihood strategy today. Converting forest to pasture is the primary cause of deforestation in the Ecuadorian highlands (Wunder 2000) as a whole and in Saraguro specifically (Belote 1984).

Why have so many Saraguros converted their forested land to pasture? Wunder (2000) calls clearing forest for pasture, “a perfectly rational strategy for the individual decision-maker (p 214)”. It is “rational” for several reasons. Cows bring in steady earnings in the form of cheese which can be sold daily or weekly. Cattle also serve as a form of savings, because they can be sold to cover regular expenses or in case of emergency (Belote 1984, Wunder 1996, Wunder 2000). Cattle may provide a more secure savings account than the ones provided by banks. During the banking crisis of 1999, for example, many Ecuadorians lost their savings. Selling cattle was also one of the few ways indigenous people could raise capital, since other avenues were closed to them (Wunder 2000). Prior to the 1970s Saraguros did not have many other economic opportunities besides cattle production. Indigenous Saraguros were not allowed to attend high school until the 1970s, and government jobs were also closed to them (Belote 1984). Cattle also enhanced the subsistence base of Saraguro’s livelihood strategy, because bulls are used to plow fields (Belote 1984).

Converting forest to pasture also makes sense in terms of where Saraguros own land. Most of Saraguro landholdings are in the cerro (Belote 1984, Wunder 1996). These upland sites are too cold for growing other commercial crops such as coffee, tree tomato, and sugar cane. Pasture was one of the few commercial uses for this forested land. And as Wunder (2000) found in his study of native forests in the
province of Loja, cattle production, “da mas dinero por menos trabajo (it provides more money for less work) (p 133)” than other land uses.

Cattle are also valuable; because they are a more mobile commodity than timber, firewood, or agricultural crops. Wunder (2000) points out that cattle can walk themselves to road heads. This allowed Saraguros to take economic advantage of forested lands located far from settlements that would not provide economic opportunities for cultivating or harvesting other products because of transportation constraints.

Powerful incentives for forest conversion exist, but not all forested land around Saraguro is suitable for pasture. Belote (1984) laid out the biophysical factors that determine pasture suitability. Water availability is a determining factor in pasture placement, because it is needed for cows to drink and for nourishing pasture grass. For this reason, pasture is rarely established on ridge tops. Steepness is also an important consideration as cows can injure themselves on very steep slopes by falling and tangling themselves in their tether. Gently sloping or flat land, on the other hand, can have serious drainage problems. Poor drainage can cause pasture to become muddy and inhibit grass growth. On gently sloping land owners frequently build small drainage ditches, but sometimes it is necessary to build large ones (one meter deep by a half meter across) which is quite labor intensive.

On suitable forested land, pasture is established from a half-hour up to six hours walk away from primary settlements. Today many people walk between two and three hours to their pasture each way. When pasture is more than 1 ½ hours away, landowners build a small hut for spending the night called a choza (Belote 1984).
Clearing forest, then establishing and maintaining pasture is labor intensive. Through the 1970s forests were still cleared with an axe and a machete (Belote 1984). One key informant described how felling one large *Podocarpus* with an axe took a person between one and two full days of work. Most vegetation was cut down, although a few large trees were sometimes left standing (Belote 1984). These were cut down at a later date when there was more time (Belote 1984) or were saved as a future source of timber and firewood (Wunder 1996). Many of the felled trees were used for lumber and firewood, but everything else was burned (Belote 1984). Land was typically cleared by the *cuadra* which is about 2/3 of a hectare. When Belote (1984) conducted his research in the 1970s, clearing one *cuadra* of forest took 10 – 12 person days. Sometimes indigenous or white laborers were hired. If laborers were hired, clearing one *cuadra* of land cost between $5 and $7. In the years since Belote’s research, chainsaws have been adopted and labor wages have risen considerably (Wunder 2000), although the rest of the clearing process remains the same.

Once pasture is established overgrazing, erosion, and drainage are the most significant problems facing landowners (Belote 1984). According to Belote (1984) each cow needs about one *cuadra* of pasture per year. In the 1970s households owned between 10-15 animals. By 1996 San Lucas residents owned an average of 15 head of cattle, but in Saraguro that number had dropped to between seven and ten head (Wunder 1996). When one field has been grazed, owners move their cows to another field which can be several miles away. After grazing, grass needs between fire and six months to regrow before it can be regrazed (Belote 1984). Belote (1984) found little evidence of longer fallow periods, although a small number of my survey
respondents mentioned allowing bushes and ferns to grow occasionally to increase pasture fertility.

Cows must be taken to water once a day and moved at least twice a day to access sufficient forage (Belote 1984). Each morning one or more family members walk (or ride the bus and then walk) up to three or four hours to the pasture where their cows are currently grazing. Household members as young as eight years old go up to the cerro for the day to take care of the cows. The cows are milked and cheese is made from the milk in a plastic bucket while in the cerro. In the time between moving their cows, people also pass time removing weeds with a machete. Cows are left unguarded overnight, although sometimes “herders” stay in small huts in the pasture for several nights at a time, especially when the field is located far from settlements.

d. 1970s to present

In 1960s, Belote (1984) asserts, population growth began catching up with land availability. By this time much of the suitable forested land had already been converted to pasture. In the early 1970s several processes began that would eventually relieve some pressure on the remaining forests. Ecuador began exporting oil from the Amazonian lowlands in the north of the country. Wunder (2000) describes how the sale of oil not only brought money into the country directly, it also made the country eligible for foreign loans. As money poured into state coffers from loans and oil revenues, the government invested in infrastructure such as roads, schools, and health clinics. The government subsidized industrialization and energy to encourage economic growth. Efforts to strengthen national economic integration by constructing roads increased deforestation in the highlands. Converting forest to pasture became
more economically valuable when urban markets became more accessible (Wunder 2000).

The oil boom also reduced pressure on forests in a number of ways. Highland residents began using less firewood as the government subsidized cooking gas. Belote (1984) suggests that this reduced pressure on Saraguro forests. Wunder (1996, 2000) counters this claim by pointing out that forests in the province of Loja are cleared almost exclusively for pasture.

After becoming an oil exporting nation, wages and prices rose; however agricultural prices did not rise so steeply (Belote 1984). As a result, Saraguros could begin to make comparable or even more money as a laborer than working their own lands. This was one factor that Belote (1984) suggests led to occupational diversification. Many Saraguros joined crews to build roads and irrigation systems. They began advancing their education beyond the elementary level. In the early 1970s, indigenous students were finally allowed to attend high school as a result of increased government funding and recognition of indigenous rights (Belote 1984). With higher levels of education indigenous people were able to compete for professional jobs (Belote 1984). Many Saraguros became teachers and some found positions in the government. Other individuals found work with international development organizations that were working in the area. Partly as a result of this extension work, Saraguros expanded beyond subsistence agriculture to cultivating commercial crops such as tomatoes, babaco, tree tomatoes, and other vegetables (Olson 2005). Saraguros, like other rural residents throughout the highlands, migrated to the cities and the coast to work for wages that supplemented their farm income (Belote 1984, Wunder 2000). Today Saraguros work as doctors, nurses, schoolteachers, mechanics, shopkeepers and politicians (Macas et al. 2003). Some
Saraguros have migrated temporarily to the United States for work, and since 1998 more than a thousand have moved to Spain for the same reason (Macas et al. 1998).

Occupational diversification would not have been possible without the movement by indigenous Ecuadorians to assert their rights. An Indian Identity Movement emerged as indigenous people in Saraguro, and throughout the Central Andes, worked to open up the societies that had oppressed them for so long (Macas et al. 2003). Figuring out how to maintain their indigenous culture while also adapting it to the modern world was also an essential part of the movement (Macas et al. 2003).

The Saraguros, as Belote (1984) writes:

have become engaged in an emergent process of “ethnogenesis”. They are redefining and refining what it means to be Saraguros in the modern world, holding onto their ethnicity as they change it (p 316).

Saraguros established two political entities to defend their interests, formed links with other indigenous groups in Ecuador, and looked to the past to revive their Incan heritage. Saraguros have been at the forefront of the Indigenous Movement in Ecuador. One Saraguro, Luis Macas, was particularly influential in the indigenous movement. Macas was a founding member of CONAIE (the Confederation of Indigenous Nationalities in Ecuador), and Pachakutik - the indigenous party that helped to overthrow the president in 2000 and elect one from their party in 2002 (Macas, et al. 2003). He was also the first indigenous person ever elected to Congress. Saraguros have also made significant efforts to increase their level of formal education. In 1997 only 68 Ecuadorian indigenous people were attending universities and half of them were Saraguros (Macas et al. 2003).
3. Major actors / institutions
   a. Cabildo (community governing council)
      During the 1970s indigenous communities began to establish legally recognized
governing councils called *cabildos*. Belote (1978) reveals that communities were at
first reluctant to adopt the new system that was being strongly encouraged by the
United Nations development organization Andean Mission. The resistance was due in
part to fears that the *cabildos* would threaten individual autonomy. As Belote (1978)
describes, Saraguros did not want other community members telling them what to do.
There was also concern that the council would control community members by being
coopted by outside entities. Today most indigenous communities in the region have
formed a *cabildo* (personal observation). The *cabildo* is composed of a locally
elected council that is legally recognized by the national government and is eligible for
development funds. The body is governed by a president, vice-president, treasurer,
and secretary that are each elected for a one year term. The elected representatives
guide discussion but cannot make decisions on their own as decisions are made by
consensus among the meeting participants (personal observation). The elected
representatives can represent the community to outside institutions but cannot come
to agreements with outsiders without first discussing the issue in a community
meeting. Meetings are held once a month. All community members are welcomed to
the meetings, but most community members usually do not attend.

   b. State

   The Saraguro county governing seat is located in the town of Saraguro and the
Loja county seat is located in the city of Loja. County governments have little
independence from the national government and most county projects must be
approved by the national government (personal observation). The national government also has a Ministry of Agriculture office in Saraguro.

On a national level, the last decade was characterized by instability. The country has had six presidents in the last nine years. Late in the 1990s the country was wracked by bank collapses, high inflation, and large general strikes (Economist 2005). In 2000 Ecuador switched its currency over to the dollar, which many people in Saraguro said made everything more expensive.

According to the corruption watchdog group, Transparency International, the country suffers from high levels of corruption. Its 2001 Global Corruption Report found that, “95% of reports approved by the Comptroller General showed severe irregularities in handling public funds” (Transparency International 2001). I observed that many people in Saraguro considered corruption to be a major problem in the country. In 2002, the Saraguro indigenous people helped electe president Lucio Guttierez on an anti-corruption platform, and in 2004 the mayor of Saraguro County was forcibly removed from office on corruption charges by a group of mostly indigenous Saragueros.

c. NGOs

There has been substantial NGO involvement in the lives of the Saraguro indigenous people. Andean Mission was the first NGO to work in the Saraguro area starting in the early 1960s. The project was funded by the United Nations and it collaborated with at least three Peace Corps volunteers including Linda and Jim Belote, who have continued their involvement in Saraguro throughout the last 40 years. Andean Mission worked to improve human health and farm productivity. The Peace Corps has had the most long term presence in the area. Jim Belote, the first
volunteer, came to Saraguro in 1962. Since then volunteers have served almost continuously in the areas of natural resources, agriculture, animal production, and human health. I observed that the majority of residents in the parishes of Saraguro and San Lucas had known at least one Peace Corps volunteer.

The two other main international NGOs are Plan-International and CARE. In the early 1980s, Plan-International began installing community drinking water and irrigation systems (Olson 2005). Plan’s work centered on improving health and agricultural productivity. The widespread existence of home gardens around Saraguro can be attributed in part to Plan’s efforts (Olson 2005). CARE’s work began in 1983 and went through the mid-1990s. An in-depth examination of CARE’s work in Saraguro can be found in Olson (2005). CARE established pine plantations with communities and private land owners, as well as integrated soil conservation projects (Olson 2005). A primary goal of the pine plantations was supplementing dwindling supplies of firewood and timber from the native forest (Olson 2005). The organization also promoted agroforestry to improve pasture and established orchards and home gardens with private individuals (Olson 2005). Environmental education about the importance of trees and the ecosystem services they provide was integrated throughout all of these projects (Olson 2005).

CARE collaborated with Plan-International and the Peace Corps in encouraging the conservation of the Washapamba cloud forest. Washapamba is a 217-ha area located six kilometers to the south of the town of Saraguro. It is communally owned by the indigenous communities of Lagunas, Ilincho, and Gunudel-Gulacpamba. Key informants said that, with the help of local extension agents, the NGOs educated community members about the importance of conserving the area through meetings, put on by the cabildos, and during lunch at *mingas* (communal work days) in
Washapamba. The NGOs sponsored *mingas* (by paying for the food) and supplied building materials for signs, trails, tourist brochures, and the construction of trout ponds. Key informants\(^5\) also said that the organizations paid the salaries of park guards in the early 1990s to prevent people from harvesting firewood and timber from the newly established protected area. According to several key informants, the protected area was established to protect water resources, to ensure that some cloud forest existed for future generations, and as a source of income generation through ecotourism. Ecotourism has yet to bring much money into the three communities, but my interviews with over 50 members of the communities indicate that protection of the area has wide community support.

All of the locally based NGOs receive some or all of their funding from abroad. I found that funding for local NGOs came mostly from Spain and the United States. Several local NGOs are currently active in the Saraguro area. A list of a few of the more prominent ones follows: Kawsay, Wampra, Kulky Yaku, Wayra, and ACOSL (Association of Communities and Organizations of San Lucas). Their work centers on natural resources, ecotourism, agriculture, animal production, health care, and maintaining Saraguro indigenous culture.

The indigenous people are also organized around two competing political groups: Corpukis (Coordinated Organizations of the Saraguro Indigenous Pueblo) and FIIS (Interprovincial Federation of Indigenous Saraguros) which are each aligned with a different national indigenous organization. Macas et al. (2003) describe these two groups as being critical or even hostile to each other, although they have joined together on several occasions “when the need is great,” as they did in 2004 to

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\(^5\) Key Informants are local people who I interviewed during the course of my study.
overthrow the mayor of Saraguro County. The two groups coordinate political efforts among the Saraguros as well as involve themselves in development work.

4. Gender Roles

Saraguro culture is fairly egalitarian (Belote 1978, Belote 1984). Parents pass their land on equally to sons and daughters. A husband and wife continue to individually own the land they received from their parents after their marriage. Most tasks can be done by both men and women, except for just a few gender-specific tasks such as plowing and weaving (performed by men) and spinning (by women). Women have also achieved notable professional success. A list of a few of the professional positions held by women during my research period in Saraguro follows: elementary school director, nurse, community governing council president, county commissioner, small business owner, local NGO director, director of the local Bilingual Education Department, and Secretary to Ecuador’s Ambassador to the United States. Saraguro women do not have all the same opportunities to men, but they are nearly equal. In light of the near gender equality in Saraguro the role of gender in conservation will not be explored.

Saraguro society is largely egalitarian and individual autonomy is valued (Belote 1978, Belote 1984, Macas et al. 2003). Throughout their 500 year history in Ecuador, the Saraguros have repeatedly shown their ability to adapt to change and to take advantage of the new opportunities that these changes present. This adaptability has contributed to the resiliency of Saraguro indigenous culture.
IV Methods
A. Definition of Terms

The term “forest” refers only to the cloud forest that is native to Saraguro and not to plantations of non-native trees such as pine and eucalyptus. Saraguros clearly distinguish between the two. Non-native patches of trees are referred to locally as “plantations,” and are almost never referred to by the terms used to note native forest. Several Spanish terms are used for native forest. The most common Spanish terms are montaña and bosque which literally mean “mountain” and “forest” respectively.

B. Forest Location

The forests of concern are situated within the large mountain range known as Cordillera Cordoncillo, which forms the eastern ridge of the Andes in Ecuador’s southern provinces of Azuay and Loja (Ridgely and Greenfield 2001b). The forests are located to the south and east of the town of Saraguro where they straddle the continental divide. They can be found on both sides of the highway that runs south to the city of Loja. Puglla and Acacana, the most prominent peaks in the region, are included in the study area. Puglla forms the northern boundary of the forests, along with the sectors known as Uritusinga and Torre. The forests are bound on the west by the sectors of Quebrada Honda, Ramos, and Fierro Urku. To the south the forests
include the mountain of Suniurku and the Tambo Blanco sector. Imbana and Jimbilla form the southern boundary. To the east the Saraguro forests stretch towards the largely unfragmented forests of the Cordillera de la Paz and the Cordillera Sharac.

C. Research as a Peace Corps Volunteer

Research was conducted in Saraguro, Ecuador between May 2002 and August 2004 while I served there as a Peace Corps volunteer. According to the IFRI research program, information should be collected by researchers;

who are deeply familiar with the local settings rather than collected from secondary sources that are compiled by international organizations or by national agencies drawing on various sources of externally compiled information (Ostrom and Wartime 1995)

Peace Corps service provided a unique opportunity for research that contributed to the internal validity6 of my findings, although in some situations the service may also have comprised such validity. Living and working in the study area for a long period of time allowed for a more sophisticated understanding of the complexities surrounding resource conservation that would not have been apparent if the research had been conducted over a shorter time period.

Due to their long history of oppression, Saraguros can be distrustful of outsiders. A level of trust was established between myself and the participants, which improved the internal validity of the study. I taught participants’ children the schools, helped during their community workdays, and shared meals with them during fiestas. Because of this involvement, all but three households agreed to answer my questions and most appeared to answer honestly. Most participants had worked with other Peace Corps volunteers during the last 43 years of the organization’s involvement in Saraguro. This opened many doors for me as people recalled their positive

6 Internal validity has to do with the truthfulness of people’s responses.
experiences with previous volunteers. I am indebted to these volunteers for building an environment of trust in which to conduct my research.

Peace Corps volunteers worked in the areas of health, animal production, organic agriculture, and natural resource conservation. Many participants knew that volunteers valued sustainable resource use, so it is possible that some of them tailored their responses to what they thought the Peace Corps volunteer wanted to hear. I admit that some respondents may have given me a strategic response, but there was strong agreement to my questions among respondents. It seems unlikely that almost every participant lied in the same way. If responses were strongly strategic, someone probably would have broken ranks. Although some responses may have been biased toward resource conservation, most respondents would have been unwilling to share their land management decisions with me if they had not known me as a Peace Corps volunteer. I hope that the relationship of trust that was cultivated between myself and the respondents mitigated for some of this bias.

D. Multiple Methods

The IFRI and Adaptive-Renewal frameworks emphasize the importance of using both quantitative and qualitative methods to understand social-ecological systems (Ostrom and Wartime 1995, Holling 2000, Berkes et al. 2003). Multiple methods were used to uncover the factors that contribute to conservation and to mitigate for a possible conservation bias expressed by participants. Both quantitative and qualitative data were gathered through short-answer interviews, wealth ranking matrixes, semi-structured key informant interviews, direct observation, as well as archival and historical research. All interviews were conducted in Spanish. Combining quantitative and qualitative data provides a more powerful and nuanced
explanation of the factors that contribute to conservation than one approach alone could provide. Quantitative data allows me to identify trends, while qualitative data provides depth for understanding the complexity of social-ecological systems.

1. Short-answer Interviews

Short-answer interviews with 60 landowning households make up the heart of my study. Participants answered questions about how they used their forest, biophysical aspects of their forested lands, their involvement with governmental and non-governmental institutions, management plans, as well as demographic and economic factors. In recognition of the Adaptive-Renewal Cycle (Holling 2000, Berkes et al. 2003), special attention was paid to how household members valued their forest and how those values may have changed over time. Due to the small sample size in my study, generalization were difficult to make.

Interviews were conducted on the household level. Households can be recognized as one production unit, where the labor of its members is coordinated and members all “eat out of the same pot.” A household included all of the people who lived in and/or contributed to the household’s livelihood. Spouses working abroad and sending home remittances were considered to be part of the home household. Adult members of the households answered survey questions. On many occasions more than one member contributed answers. Sometimes members within one household offered distinct perspectives on the value of forests and livelihood issues. The inclusion of multiple viewpoints in the interviews highlights generational differences as well as the heterogeneity of households. I transcribed all household interviews within one day of conducting them. If questions came up during the transcription process, I returned to the household to seek clarification.
Households were randomly selected, which presented some challenges. Lists containing the names of all community members are difficult to come by. Such lists would have offered little help, though, because so many people have the same first and last names. The lists also would not have indicated where community members lived. Therefore, a map was laboriously drawn of every household (some households have more than one building) in each community. Each house was then numbered and those numbers were drawn from a hat to randomly select the households.

Households came from the following four indigenous communities: Lagunas, Gunudel-Gulacpamba, Tuncarta, and Pichig. A community is defined as the legally recognized groups of households that are represented by an elected governing council called a cabildo. Communities typically have between 100 and 150 households that can be spread out over two square kilometers. The area has more than a dozen other small communities besides the ones chosen. These four communities were sampled for two reasons. In each of the four communities a high proportion of members own forested land within the study area and Peace Corps volunteers have a good reputation there.

Lagunas, Gunudel-Gulacpamba, and Tuncarta are located in the Saraguro Parish, while Pichig is located across the continental divide in San Lucas Parish. Despite the political distinction, Pichig is united to the other three communities by a common ethnicity and by the fact that members own land in the same forested area. The communities of Lagunas, Gunudel, and Ilincho (which was not included in the study) own the Washapamba Protected Forest. All interview participants were indigenous.
2. Wealth Ranking Matrixes

Accessing household wealth presents several challenges. Saraguro’s subsistence base was difficult to quantify. Most households sell cheese on a daily or weekly basis, but this varies depending on how many cows are giving milk. In addition, households earn money from a wide range of sources that range from selling vegetables and handmade clothing to wages from employment and remittances from Spain. Income also varies throughout the year depending on when cattle are sold. Not only is household wealth difficult to quantify, but it is also highly variable.

In light of these difficulties, the wealth of each participating household was ranked by three different key informants in each of the four communities. Key informants were asked to determine which households were in the low, medium, or high economic category compared to other households within their community (not in comparison to households in the rest of Ecuador or in the world). Key informants used their own criteria for determining wealth of households. The wealth rankings by informants were averaged to determine household wealth. The wealth ranking was cross-checked for accuracy with livelihood information gathered during household interviews and through direct observation.

3. Semi-structured Key Informant Interviews

Semi-structured interviews were conducted with 21 key informants. These differed from household interviews in that key informants were not selected randomly and the interview’s scope was limited to one specific topic. Key informants included former community presidents, extension agents for development projects, and the regional directors of the Environment Ministry’s Wildlife and Forestry Departments. Perspectives were also gathered from a variety of other key informants who had less
formalized involvement in forest conservation. These ranged from respected indigenous elders, traditional woodworkers, cultural leaders, and healers to people who were privy to the capture and selling of Spectacled Bears. These semi-structured interviews provide a context for the factors raised in the households.

4. Direct Observation

Throughout the 27-month study period, extensive notes were written in field journals from direct observations. Notes were taken on religious observances, forest uses and community, county government, and NGO meetings. Observations on climate and forest characteristics, including species composition and interactions, were also recorded. This participant observation was highly valuable for understanding the context of forest management in Saraguro.

5. Archival and Historical Research

Secondary data were gathered through archival and historical research. These data include government documents, internal reports from NGOs and census data. This task was made particularly difficult by the fact that Saraguro’s government offices were closed by protests and strikes for several months. Some of the internal NGO documents had to be tracked down in homes of various extension agents.

This study grew out of the work of other people who have conducted research in Saraguro. Three dissertations and numerous scientific articles have been written about the area. The anthropologists Linda and Jim Belote have written extensively on the area for over 40 years. Their research and friendship were invaluable for helping me tease out the factors that contribute to forest conservation. The archaeological work of Dennis Ogburn advanced my understanding of pre-historic forest uses. My
husband and fellow Peace Corps volunteer, Mark Olson, conducted research on the use of trees and changing land use patterns in Saraguro. My study grew out of a pooling of our data and many long discussions with Mark about what they mean. Together our research explores different yet complimentary aspects of natural resource use in Saraguro.

**E. Analysis**

All data were transcribed in Spanish and remained in Spanish throughout the analysis in an effort to retain the original meaning of participants’ comments. Only the quotes selected for this write-up were translated into English and that was done at the end of my analysis.

The IFRI and the Adaptive-Renewal frameworks (Ostrom and Wartime 1995, Holling 2000, Berkes et al. 2003) guided the selection of interview questions, but the analysis was “grounded” in the data that were generated. The identification of factors that contribute to conservation grew out of the comments made by interview respondents and key informants themselves. I read and re-read the narrative text from the interviews in search of response patterns and to assemble categories and explanations.

Interview and wealth ranking data were entered into a QSR N-vivo database and coded for themes and variables. The QSR N-vivo program was used for qualitative analysis. The SPSS program was used for quantitative analysis.

Since households were randomly selected, several of them had never owned forested land and, therefore, never had the opportunity to decide whether or not to conserve it. These households were excluded from the analysis. The remaining respondents were grouped into “conservers” and “non-conservers.” A “conserver”
household is one that has decided not to cut their forested land. "Non-conservers" are planning to convert their forest to pasture or have already done so. The conserver households that clearly could not convert their forest to pasture due to biophysical limitations were removed from the analysis of all other non-biophysical factors.
V Findings

A. Intro
   1. General Household Characteristics
   2. Identification of contributing factors
   3. Multiple and conflicting reasons

B. Population Change

C. Biophysical Factors
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   2. Elevation
   3. Access / Distance

D. Livelihood Strategies
   1. Household size
   2. Wealth Ranking of Households
   3. Occupational Diversification
      a. Off-farm Income
      b. Commercial Agriculture
      c. Remittances
      d. Primary Income Source
   4. Labor Scarcity and Wages

E. Role of Government
   1. Cabildo
   2. County and National Government

F. Forest Value
   1. Why forests are valued
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      b. Ecosystem Services
      c. Wildlife Habitat
      d. Wellbeing and Cultural Reasons
      e. Option Values
   2. Changing Forest Values and Management
      a. Forest value among older generations
      b. Differences in forest views among generations
      c. Formal Education
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      e. Life experience and history

G. Differentiations of the Factors that Contribute to Conservation

A. Intro
   1. General Household Characteristics

   I conducted short-answer interviews with 90 households. Thirty of those households were not included in the analysis, because they had never owned forest.

   The remaining 60 households raised cattle or had done so in the past and were currently renting their pasture. Except for cattle production, households varied widely
in most other factors under consideration. Households ranged in size from 1 – 12 people. Some were dedicated solely to the traditional “corn and cattle” livelihood strategy, while others had adopted a wide range of alternative occupations. Reported land ownership ranged from less than one hectare up to 30 hectares. Members of some households had never attended school, others had attended elementary or high school, and still others had university degrees. Households valued forests for a wide array of reasons as well.

Of the 60 households that owned forest or had owned forest in the past, 43 of them (72%) said they planned to conserve some or all of their forest and will be referred to as “conservers”. These conserver households specifically said they were not going to cut their forest or convert it to pasture. Seventeen households (28%) planned to convert their forested land to pasture or had already done so. These households will be referred to as “non-conservers”.

<table>
<thead>
<tr>
<th></th>
<th>Households</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservers</td>
<td>43</td>
<td>72%</td>
</tr>
<tr>
<td>Non-conservers</td>
<td>17</td>
<td>28%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 3. Breakdown of households into conservers and non-conservers

None of the conserved lands were legally protected nor did any respondent express interest in legally designating their land a Protected Forest with the Environment Ministry. This does not mean, however, that these conservers lacked conviction to conserving their forest. Establishing a Protected Forest on private land required a lot of work, time, and money. According to Environment Ministry officials, forest species have to be inventoried and a lawyer has to be paid to draw up the paperwork. Several trips to the provincial capitol were also necessary to meet with government officials. Landowners that legally establish a Protected Forest can receive tax breaks, but some were unwilling to do so; fearing that they would end up
paying more taxes if their land had not been appraised correctly in the first place. Key informants indicated that landowners may be unwilling to protect their forest legally for fear that the government might control access to their land or even take it away.

Privately owned forests that are only informally protected by their owners may offer no less protection than is accorded by the government to legally protected areas. They may even be better protected than their legally recognized counterparts, because, as described in the literature review, government protected areas frequently do not offer much protection on the ground (Southgate and Whitaker 1992, Rudel 1993, Southgate and Whitaker 1994, Doumenge 1995, Mena 1995, Sarmiento 1995).

Nine conserver households reported owning forested land that was clearly unsuitable for pasture due to biophysical limitations. This left 34 households (79% of total conserver households) that were conserving their forest for other non-biophysical reasons. These nine conserver households with forest that is unsuitable for pasture were removed from the analysis of livelihood strategies, government influence and forest value; since biophysical limitations clearly motivated their decision to conserve.

2. Identification of the Factors that Contribute to Conservation

Households and key informants identified several key variables that influenced their forest use decisions. The variables generally fall into the following categories: biophysical limitations, livelihood issues, government influence, why forests are valued and how these values have changed.

3. Multiple and Conflicting Reasons for Conservation

Respondents frequently gave more than one reason for their decision to conserve their forested land. Decisions appeared to be influenced by a complex set of
factors. For example, the husband and wife from this conserver household both said that they cannot cut their forest because they are too old to do the work. Later in the same conversation they pair gave different reasons for their decision to conserve. The husband speaks first and the wife second.

> In the future forests might not exist and people will be without wood. So we are saving the forest. I love plants. I don't like to destroy them. We have a lot of respect for the plants. We don't destroy the forest any more. We know that it's plants are hard to propagate.

> We have to care for it. It is sacred and is not to be destroyed. It is peaceful. There is silence there. Here [in the community] there are a lot of fights. That is why we are not destroying it. [s2001]

Another respondent said she left the forest above her pasture standing as a forest product reserve, because the land is too steep and high to be suitable for pasture. Then she said she conserves her forest because it “attracts the water and purifies the air.”

The frequency with which respondents gave multiple reasons for conserving their forest made it difficult to tease out what factors really influenced decisions making. But this could be seen as a strength of the study. A complex set of incentives drives landowners' decisions. The fact that multiple reasons came to light during the course of the household interviews suggests that responses reflected the complexity of the issue for landowners. My job would have been easier if respondents had given one simple answer to explain their decisions, but the validity of the study would have been questionable, because humans rarely do things for one simple reason.

B. Population Change

The population changed little during the last three decades in the area where the four study communities were located.
Figure 10. Population size in Saraguro and San Lucas (INEC)

In Saraguro Parish the rural population increased between 1974 and 1982 and then fell slightly during each following decade (Instituto Nacional de Estadísticas y Censos 1974, 1982, 1990, 2001). Between 1974 and 1982 the population grew by 4.63% (0.58% per year). From 1982 to 1990 the population changed by -1.16% (-0.15% per year). Between 1990 and 2001 the population also fell, this time it changed by -0.75% (0.07% per year). Wunder (2000) found that large numbers of rural residents moved to the cities during the last 30 years, which may explain the population decrease in the Saraguro Parish. The decline between 1990 and 2001 could partially reflect temporary migration to Spain and the United States.

The demographic situation differed in the rural parts of San Lucas Parish where population fell between 1974 and 1982, but increased slightly in the following decades (Instituto Nacional de Estadísticas y Censos 1974, 1982, 1990, 2001). From 1974 to 1982 the population changed by -7.01% (-0.88% per year). It then grew between 1983 and 1990 by 4.28% (0.54% per year). The population grew by 7% (0.64% per year) between 1990 and 2001.
Table 4. Population size in Saraguro and San Lucas (INEC)

This population growth rate was higher than that in other rural areas of the country as a whole; which grew by 0.2% annually between 1980 and 2000 (Earthtrends 2003). The small growth in population size during the last three decades may be explained, in part, by migration to urban areas within the country and to the United States and Spain. During this same time period population growth in Ecuador’s urban areas was 4% annually (Earthtrends 2003). As a whole Ecuador’s population grew from 3,387,000 in 1950 to 13,112,000 in 2002 (Earthtrends 2003). Even though the population size has not increased much within the study area, the growing population in other parts of Ecuador probably increased pressure on Saraguro forests by increasing demand for cheese and beef.

C. Biophysical Limitations

Most of the forested land owned by study participants can be converted to pasture, but some areas were unsuitable for pasture, because they were too high, too steep, or too far away. Belote (1984) asserts that most of the suitable land has already been converted. This respondent agreed, “The majority that can be turned [into pasture] has already been made [1021].” In describing her three forested land holdings, another respondent said, “The forest is located in the part that is no good for pasture [4011].” It is no good for pasture she said, because the land is too high and too steep. Were landowners conserving their land just because it was not suitable for pasture? The answer is “no” for the majority of respondents – their forested land was

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7 The four-digit numbers in brackets refer to the household number.
suitable for pasture, but they were conserving it anyway. Seventy-nine percent of conservera stated that their forested land could be converted to pasture.

Twenty-one percent of conservera said they could not turn their forested land into pasture because of biophysical limitations.

*It is really steep. It is not possible to make pasture there so I leave it as forest.* [1001]

While biophysical limitations did not influence the majority of conservera, they were an important factor for a small portion of respondents. The following section explores how biophysical limitations contributed to forest conservation for about a fifth of conservera.

1. **Steepness**

Respondents noted that steep slopes were a significant biophysical limitation.

*It is steeper than the pasture. That is why it is forest. Pasture needs a lot of water. Where the forest is located it's really steep. It is dry where it is steep. It does not make good pasture.* [4001]

Pasture made on steep land does not last long either. One respondent said making pasture on steep land is a waste because it only lasts for four years. Another respondent pointed out that steep pasture can be dangerous for cattle. In such places, he said, “the cows fall down.” Falls can result in injury or death.
2. Elevation

Forest elevation also appeared to contribute to conservation. Landowners leave forest standing on the sides or in the middle of their pasture, but most often it is left above their pasture. This forest-above-pasture pattern holds true for 84% of conserver households.

<table>
<thead>
<tr>
<th>Conservers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest above pasture*</td>
<td>84 %</td>
</tr>
<tr>
<td>Forest in the middle of pasture</td>
<td>5%</td>
</tr>
<tr>
<td>Forest on sides</td>
<td>2%</td>
</tr>
<tr>
<td>Unknown</td>
<td>9 %</td>
</tr>
</tbody>
</table>

*Some of these respondents also had forest all around, on the sides, and in the middle as well as above.
*Some respondents also own two forest patches. Six out of these nine owners left forest standing above their second pasture.

Table 5. Elevation of forested sites

Growing conditions were harsh at higher elevations.

_The forests are always higher. Where the forest is located, it's tough. The grass is mistreated. There is a lot of wind. It [the pasture] has to be lower down._ [1001]
In the high parts the grass doesn't grow because of the cold.

Besides creating harsh growing conditions, high elevation locations did not provide much water.

There is no water to give the cattle to drink there either.

Interview responses indicated that forest patches located at higher elevations were more likely to be conserved, because they are less suitable for pasture than lower elevation sites. Several respondents also said they left forest at higher elevations because it improved the quality of the pasture below. The role forest plays in improving pasture will be explored in the section on ecosystem services.

3. Access / Distance

Much has been written about how close proximity to settlements and improved access provides incentives for deforestation (White and Maldonado 1991, Southgate and Whitaker 1992, Young 1998, Gade 1999). Following this logic, I would expect remaining forest patches to be located farther way from settlements than pasture. Surprisingly, distance/access was not found to be an important factor in Saraguro. Seventy-nine percent of households reported that their forest was located the same distance from their home as their pasture.

*Six out of nine respondents who own two forest patches say that the forest is the same distance from their home as their pasture.

Table 6. Distance of forested land

Long distances did not appear to prevent households from converting their forest to pasture. I observed that Saraguros frequently walk two to three hours each
way to tend to their cattle. Respondents were willing to walk up to four hours each way to their pasture. Only one respondent said he had not converted his forested land because it was too far away. This land was located in Imbana which was a five hours away “walking fast” from the respondent’s home in Pichig. After saying his land was too far to make pasture he said he planned to convert this same forest to pasture in the places that were suitable for it. Another respondent who owned forest six hours walk away from his home said he planned to convert some of it as well.

Although only one respondent said his forest was too far away to be converted to pasture, several said their forest was located too far to be a source of firewood and timber. The ability to extract timber and firewood had little or no influence on forest conversion though, because Saraguro forests were almost exclusively felled for pasture and not for harvesting forest products – especially since households now get most of their firewood and timber from non-native trees such as eucalyptus and pine. All respondents who said they planned to cut their forest were doing so to create pasture.

Distance was not a factor affecting forest management up to a certain limit. Respondents did not own forested land within the study area more than six hours away from their home. These findings are unable to show if distances of more than six hours from settlements would limit forest conversion.

Biophysical limitations contributed to forest conservation in a small number of cases where forest was too steep to be converted to pasture. High elevation on the other hand strongly encouraged conservation. Households typically left high elevation land in forest because it was unsuitable for pasture or improved the quality of the

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8 A small number of respondents owned forested land in the Oriente region. These lands were beyond the scope of this study.
pasture below. Distance and access, however, did not play a role in decisions to conserve in the Saraguro context.

Households that owned forested land that was unsuitable for pasture were removed from the analysis for all of the following sections. Biophysical limitations clearly motivated their decisions to conserve their forest. By removing these households, the number of conserver households is reduced to 34 or 79% of the initial conserver group.

D. Livelihood strategies

1. Household size

Households ranged in size between 1 and 12 members. The majority of both conserver and non-conserver households had between 5 and 8 members.

![Bar chart showing household size distribution.]

**Figure 12. Household size**
No relationship was found between household size and forest management ($X^2 = 0.750$, df = 2, $p = 0.687$).

2. Household Wealth Ranking

Key informants used their own criteria for determining household wealth. Key informants identified the following criteria as being important for ranking wealth.

Households were ranked in the lowest economic category if they had small holdings and/or had a low level of education. Most informants said households in the lowest economic level “do not have possibilities.” Households that rely solely on cattle and subsistence agriculture were placed in the lowest economic category. Households with members that lacked the skills to have a profession (or be a skilled laborer) were considered to be poor. Single women were always placed in the lowest category. One informant, who was a highly respected elder, identified young people as being poor, because “they are just starting their lives.” Another informant said older people cannot make a good living. Having a lot of kids also put households in the lowest economic level. Two informants said households in the lowest category do not have enough food to eat.

Middle class households were identified as having both more land and more opportunities. They had higher levels of education and more skills that allowed them to diversify their livelihood strategy so they no longer depended on just “corn and cattle.” They were teachers, skilled laborers, or worked at one of the government sponsored daycare centers, among other things. Mid-level households were more likely to receive remittances from abroad than households in the lowest category. Households in the middle wealth category also had fewer children.
All informants said households in the highest economic category had the most land and most cattle. They had the nicest houses and some even owned cars. Households in the highest economic level also had more off-farm economic opportunities. Members of many of these households had university degrees. Many had a profession as a schoolteacher or as a governmental or NGO official. These households may have had a small business such as a small general store in their home. Many received remittances from Spain or the United States. One informant identified high income households as the ones that still owned forested land that they could afford to conserve.

The main factors that improve household economic status were larger landholdings, higher education levels, and occupational diversification which included off-farm income sources and remittances.

Wealthier households were significantly more likely to conserve their forest than poorer households ($X^2 = 6.339$, df = 2, $p = 0.042$). Thirty-two percent of conservers were in the high economic category, while just 6% of non-conservers were in this upper category. In the lowest economic category, 53% of non-conservers were placed, while just 24% of conservers were in this lowest category.
Wealth Ranking

Proportion of Households

![Bar chart showing proportion of households in wealth ranking categories]

Figure 13. Household wealth ranking

Interview responses indicated that economic well-being affects forest management decisions. All non-conservers said they cleared their forest for pasture or planned to do so. Many pointed out that raising cattle was the only way they had to make a living. Economic necessity drove this household's forest clearing:

*We cleaned and burned it all. We had to sell cattle to eat, to buy things. We need pasture. For the educated people – they don’t value pasture. They live in a different way. We are campesinos and we have to live on our own. Without pasture how can we live? How can we eat? [1017]*

The two members of this household were seniors who had never attended school. They depended on cattle production because they did not have other economic
opportunities. Another non-conserver also identified economic need as the reason for his forest clearing:

_We cut. We made pasture. We raised animals to get out of poverty a little._ [3002]

He said he regrets cutting all of his forest. “It’s good,” he added, “to look for other ways of making a living.” He has since diversified and supplements his cattle production with income from by selling the tomatoes and fruit. These non-conservers acknowledged that occupational diversification allows forest owners to consider other management option besides conversion to pasture.

### 3. Occupational Diversification

Since occupational diversification expanded forest management opportunities beyond clearing, were conserver households more likely to have alternative options such as off-farm income sources, commercial agricultural, or remittances from household members living abroad?

#### a. Off-farm Income

Off-farm income included salaries from professional positions, wages from skilled and unskilled labor, and profits from small businesses such as a small in-house general store, taxi service, or clothing store. Income from raising cattle in the Oriente was also considered off-farm income because the earnings did not come from their Saraguro farm. Neither commercial agriculture nor remittances were included in this category.

Off-farm income opportunities appeared to influence households’ decision to conserve. Households with off-farm income were significantly more likely to conserve their forest than households without off-farm income ($X^2 = 5.667, df = 1, p = 0.017$).
Fifty-nine percent of conservers generated off-farm income, while only 24% of non-conservers do.

Several conservers said they did not need to convert their forest to pasture, because they had off-farm income opportunities.

*We don't need more pasture. I got out of raising cattle. We don't have cows anymore. The pasture is rented out. We have our general store and we don't need to raise cattle and we don't have the time.* [1007]

*If we did not have the [car] workshop and my work for the institution [NGO], we would have to dedicate ourselves to raising cattle. We probably would have cut all of our forest to make pasture. But we have other opportunities and can afford to leave some of our forest standing. In the past people only had cattle production and so they had to cut the forest.* [3018]

Working in the Oriente took pressure off one household's forest.
We did not cut our forest because in the past we went to work in the Oriente. As a result our forest rested. [2001]

These results suggest that off-farm income opportunities contribute to forest conservation. Caution is warranted, though, because several factors usually went into a household’s decision to conserve. One respondent said his government employment meant that he was no longer dedicated to cattle production. But he emphasized that he is conserving his forest because it protects the watershed and plays a role in maintaining indigenous culture. According to this respondent, these considerations were more important than livelihood factors.

b. Commercial Agriculture

Since the 1970s, Saraguros have diversified agricultural production on their farmland. Instead of just growing crops for subsistence, many households now cultivate a variety of commercial crops such as babaco, tree tomato, and other vegetables. Before the 1970s, households only sold cheese and beef-on-the-hoof, but now they also raise pigs, guinea pigs, and chickens for sale. Did income from agricultural commercialization take pressure off households to convert forest? If so, more conserver households would be involved in commercial agriculture than non-conservers. A relationship was found between a household’s involvement and deforestation. Households involved in commercial agriculture were significantly less likely to conserve their forested land ($X^2 = 4.112, df = 1, p = 0.043$). Eighty-nine percent of non-conserver households produced crops commercially compared to just 59% of conserver households.
Household Involvement in Commercial Agriculture

Figure 15. Household involvement in commercial agriculture

Increased involvement in commercial agriculture did not provide an incentive for conserving forest. Increased involvement in commercial agriculture does not appear to take pressure off forested land. It is important to note that households were intensifying production on their existing cropland to grow commercial crops. They were not clearing more forest to grow crops for sale. All non-conservers said forests were cleared for pasture and not for cultivating other crops.

c. Remittances

Many conservers and non-conservers received remittances from household members working in United States, Spain, or other European countries. Respondents
said remittances provided money for daily expenses as well as capital for starting or enhancing small businesses. For example, one conserver household used money generated from work in Spain to open up a clothing store and restaurant. This household continued to raise cattle, but their small businesses became an important source of income. Another conserver household used remittances from Spain to buy additional land – some of which the household planned to conserve. Conservers were only slightly more likely to receive remittances than non-conservers. Fifty percent of conserver households received remittances, compared to 44% of non-conserver households. No significant relationship was found between receiving remittances and forest conservation ($X^2 = 0.17, df = 1, p = 0.680$).

No respondents said that remittances influenced their decision to conserve.

d. Primary Income Source

Despite moves toward alternative livelihoods, “corn and cattle” remained important to many households – especially non-conserver households. More non-conservers (65%) depended on cattle and agriculture as their primary source of income than conservers, but they remained vital for many conserver households as well. Thirty-seven percent of conserver households indicated that cattle and agriculture remained their most important source of income. Several households and key informants said that raising cattle was less profitable than it used to be. Three of these blamed dollarization for reducing the price they could get for their cattle.

4. Labor Scarcity and High Wages

One key informant and his wife had given up raising cattle in favour of working in the education system. He smiled when he explained his decision to sell his cows.
“Cows,” he said, “are so much work — without them I have more time.” His comments highlight the tremendous amount of work required for cattle production. The initial investment of labor was particularly high. One respondent described the work as being “very heavy”. The work was particularly burdensome for poor families when they have to pay laborers to help with the clearing.

The difficulty of the work and its high cost were the reasons given by eight respondents to explain their decision not to convert their forest. Even though this issue was only mentioned by just 18% of conserver households, it may offer a more powerful explanation of forest conservation that these numbers suggest. Respondents seemed reticent to admit the economic reasons for leaving their forest standing — preferring instead to talk about ecosystem services and the cultural values associated with their forest. For example, the husband of one conserver household said forests are important because they protect the environment, maintain humidity, and prevent erosion. When I asked why they had not cut their forest yet, the wife said from the background, “We don't have the money to cut [2011]”. Her husband quickly cut her off and said that they have not cut their forest because cutting is harmful for the environment. He said the land is already dry and cutting the forest will make the land even drier. The difficulty and high cost of forest clearing may be a more important factor contributing to conservation than the above numbers indicate.

The issues surrounding the difficulty and high cost of forest clearing were described by respondents in the following ways. A conserver who worked with his father clearing forest, said that in the late 1960s his father decided to stop cutting. This respondent said his father did not want to continue “damaging” the forest, then added, “He didn’t want to work anymore too, I think [1005]”. As another respondent pointed out, conserving the forest takes less work,
The pasture has to be maintained and weeded. The forest, no. It’s just there. [3011]

Households with seniors may be too old for the “heavy” work of forest clearing. Their children were often unavailable for the work, because they had adopted alternative livelihoods which reduced the labor supply available to clear forest. Wage increases made alternative livelihoods more attractive, but they also made forest clearing more expensive. A key informant said clearing one cuadra of forest (about 2/3 of a hectare) now costs $500, compared to just $5-7 when Belote (1984) conducted his research in 1970s. As a result, households whose members are working off the farm could not afford to pay laborers to clear the forest either.

Forests were affected by occupational diversification, labor scarcity, and rising wages. Respondents talked about how these factors influenced their decision not to cut their forest.

There is no time. My kids left to work in other things. [3019].

Now we are too old and we don’t have the strength to work and so the forest stays there. The trees take a lot of work to cut. You have to be young to cut. [2001]

This last respondent had four sons who made their living off the farm. One had a small business and the other was a professional in Quito. The father said his children did not want to clear the forest. In part, he says, because they worked in other things but also, because they valued the ecosystem services provided by the forest.

Several respondents said they did not have the money to have their forest cleared, which brings the discussion back to the role of household wealth in forest conservation. Twenty-four percent of conserver households were in the lowest economic categories. Many of the poorest households said they were not cutting their forest because they could not afford to.
An examination of the eight poorest households (24% of conservers without biophysical limitations) illustrated that several reasons drive their decisions to conserve. Half of these indicated that labor scarcity contributed to their decision to conserve. The heads of these households were either widows or had husbands who were too sick to help clear the forest. Two of these also said that their children could not help clear because they were pursuing alternative livelihoods. Three of the eight poorest also said that government and cabildo (community governing council) prohibitions were a disincentive for forest clearing. Three of the eight households were conserving their forest, in part, to ensure a source of forest products for the future. Four of the eight wanted to conserve because they recognized that the forest was disappearing, which they said would be harmful for future generations. These poorest households were also conserving because they valued forests for providing ecosystem services, and wildlife habitat, and contributing to human wellbeing and culture. They also hoped their forest could provide revenue from tourism in the future.

Fourteen conserver households did not earn any off-farm income; depending instead of cattle production and agriculture. Six of the fourteen were also in the lowest economic category. These fourteen households without off-farm income were conserving their forest for the same reasons described above for the poorest households.

These findings indicate that both high and low incomes contributed to forest conservation. Occupational diversification tended to increase household wealth. Conserver households were more likely to have off-farm income sources than non-conservers. The reverse was true for commercial agriculture, in which case, conservers were much less likely to be involved in agricultural production than non-conservers. A nearly equal proportion of both groups received remittances.
Conserver households were less likely to depend on cattle production for their sole source of income than non-conservers, although cattle remained important for both groups.

E. Role of Government
1. Cabildo (community governing council)
2. County and National Government

For the purpose of this discussion only two levels of government will be considered. The first level is the community governing council which will be referred to by its local name, cabildo. The second government level includes both the national and local county government. As described in the context, the national government exerted a lot of control on the county government. Respondents often grouped the two levels of government together. The local and national government were similar in that they have historically been controlled by white people and been viewed with distrust by indigenous people. The term government will refer to both the county and national government but not to the cabildo.

1. Cabildo

The cabildo appeared to play little role in individuals’ land use decisions. Eighty-eight percent of non-conservers and 82% of conservers said that the cabildo did not influence their land use decisions. The cabildo was not found to influence forest conservation. No significant difference was found between forest management decisions and cabildo influence ($X^2 = 0.297$, df = 1, p = 0.586). Most respondents also said the cabildo did not make regulations pertaining to forest management and it lacked the funds to carry out natural resource projects or provide technical assistance.
The following response was typical to the question, “Has the cabildo influenced your land management decisions or provided technical assistance?”

No. The use depends on the conscience of each person. It depends on what they know. The cabildo does not influence anything. [4001]

Within communities, households voiced conflicting views about the role of the cabildo.

While most respondents said the cabildo had no role in private land management, three respondents said the cabildo prohibited private landowners from cutting their forest. One of these said the prohibition kept her from cutting her forest. Respondents also said the cabildo educated community members about forest conservation:

The cabildo had meetings, seminars or workshops to talk about the importance of the forests for water…and it woke us up a little. [1019]

A former CARE extension agent said CARE worked together with the cabildo to reach community members.

One conserver looked to the future, saying he would like to see the community come together through the cabildo to communally manage the forested land around the Incan ruins of Ingapirka that were privately owned. A local NGO attempted to buy up these lands (in secret) and bring tourists to Ingapirka, which angered several community members. During a heated county government-sponsored meeting, several community members said the land was already communally owned and all management decisions must be approved by the cabildo. Notably, none of the households with forested land in the Ingapirka sector said the community owned or had any influence over this land.

The Pichig cabildo was legally established only two years before this study. Most Pichig respondents said it had no influence on their forest management, but there was one notable exception. A respondent, who was a former community
president, said the *cabildo* stopped a road construction company from removing the forest from one community member's land. In 2002 the company responsible for improving a nearby section of highway received permission from the landowner to mine for rock on his land. The company began clearing the forest to get to the rock. The mine was located on the skirts of Acacana Mountain, which has been considered sacred since pre-Incan times (Ogburn 2001). According to key informants, community members were angered by the road company's work; saying it disturbed the *wakas* of the mountain. When two workers were injured at the site, the disturbed *wakas* were blamed.

Figure 16. The sacred mountain of Acacana.

The community president described how the Pichig *cabildo* filed suit with the Environment Ministry to stop the project. They argued that the company's actions were illegal, because they had neglected to do an environmental impact study (EIS)
before clearing the forest. The Environment Ministry agreed with the claim and ordered the company to conduct an EIS before continuing their work. But instead of conducting the study, the company abandoned the project altogether. In this way, the respondent said, *cabiildo* was able to stop the company from clearing more forest.

2. Local and National Government

Under Ecuadorian law, cutting or burning native forest on private and communally held land is illegal without a permit. Penalties for breaking the law include confiscation of the chainsaw and a fine. Killing or removing wildlife from the forest is also prohibited. Government officials from the newly formed Ministry of the Environment admitted that the laws prohibiting the cutting of forests and killing of wildlife were difficult to enforce, in part, due to a lack of resources and personnel.

During the last census, the forestry department collaborated with census officials to inform citizens about the laws restricting cutting and burning. Stickers urging citizens not to burn their forest can be found on the doors of many houses, along side the sticker confirming that the house was counted by the census. According to the forestry department’s Loja office, this was one of the few efforts it had made to inform citizens about the forestry laws.

These regulations are ineffective for several reasons. The local Forestry office is in charge of policing a large area with a poor road system. The Forestry Department has only three people, one vehicle, and no gas money to police the four counties including those of Saraguro and Loja. Because of this, officials with the department said they rarely get out of the office. They only do so when someone comes into their office in the city of Loja to report the crime. One official with the department doubted that additional laws would be prevent deforestation, because it is
not possible to control what people do in the forest. “Change will come”, he said, “only when people understand why forests are important”.

Not surprisingly, the majority of respondents said the government had no influence over their forest management. But a larger proportion of respondents reported that the government had influenced their land management than the cabildo. Eighty-three percent of non-conserver households and 65% of conserver households reported no government influence. Again, no relationship was found between increased government influence and forest conservation ($X^2 = 1.7, df = 1, p = 0.192$).

Thirty-five percent of conservers said the government influenced their land management by providing technical assistance, environmental education, and/or by regulating forest use. Both conservers and non-conservers criticized the government for failing to provide more technical assistance to improve agricultural productivity.

_We pay taxes but the government does not give us any assistance._ [4020]

One respondent accused the government of neglecting and even lying to indigenous communities. Another pointed out that although the Agriculture Ministry offers technical assistance, it is hard to access because community members must pay for the gas to get technicians to their area.

A small number of both conservers and non-conservers were aware of the laws prohibiting the cutting and burning of forested land. This regulation did not prevent all of these households from converting their forest; because, as one of them pointed out, there is a lack of enforcement. One non-conserver knew that clearing the forest was prohibited, but was still planning to clear his forest. He also said killing wildlife was against the law, but that does not stop people from hunting. If you are caught breaking these laws, he said, you have to pay a fine and spend a couple days in jail. But he pointed out that enforcement is very “individual.” Another non-conserver, who
was also aware of the laws, said that if she clears her forest down “little by little” she will not get caught. She knew that she could legally cut her forest if she had a permit. She did not intend to get the permit, though, because she would have to go to the provincial capitol by bus to get the permit and that “costs money.”

Several conservers said the government encouraged them to conserve their forest through regulations, environmental education, and/or technical assistance.

*There were talks in the communities so that people would not cut the forests. Before we just cut the forests for our own gain, but in these talks they (the government) said people should not cut the forests. They fined us and so we stopped cutting the forest. Those talks taught us the importance [of the forest]. It was because of the talks and the fines. Now, they don’t say we can’t cut, because the people understand so they don’t cut.* [3003]

This respondent added that there were a lot of other reasons, besides government regulations, for her decision to conserve her forest. She also said that even with the fines people are still cutting, although now they do it more discreetly. She pointed out that there is no way to monitor whether people are cutting.

The forestry laws encouraged some people to conserve their forest, such as this older man. The Census officers, he said, told him that it was illegal to cut or burn the forest. He pointed to the fire prevention sticker on his door as he said this. He admitted that he was not going to cut his forest for fear of being fined “millions of sucres.”

*One day I was burning [my forest] when the wind came up and carried the fire to my neighbour’s land. I had to pay a fine to the neighbour. I had to fix it fast with the owner - very quietly - so that the government representative would not come and make me pay more.* [3020]

In this case, the law provided a disincentive for him to clear his forested land.

The county governments of Loja and Saraguro recently started a new effort to stop people from cutting their forest. Both governments put in new drinking water

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9 Ecuador used sucres for money before switching to the U.S. dollar in 2000.
systems and they were encouraging people who owned land in the drainages not to cut their forest. A conserver from Gunudel said she had just returned from a meeting where the county government told her she is not allowed to cut her forest above the water system. She also said she was too old to cut her forest.

One respondent specifically said the government was not the proper organization to lead future conservation efforts.

_It is hard with the government institutions. There are so many politics. We did some reforestation with Predesur but the trees have been abandoned. They were burned._ [1002].

Because of the difficulty of working with the government, the respondent said non-governmental organization should take the lead to conserve Saraguro forests. Another conserver expressed his distrust of the government, accusing it of trying to take away his land to turn into a tourist site.

The majority of respondents reported no government influence on their land management decisions, although ten conservers (29%) specifically said government regulations prohibiting cutting provided an incentive for them to conserve. Many of these conservers also mentioned other reasons for conserving their forest as well. Some non-conservers acknowledged that the government prohibited forest clearing, but they planned to cut their forest anyway.

The case involving the company clearing forest on Acacana indicates that government laws and the _cabildo_ can, on rare occasions, contribute to conservation. Most respondents, though, said the _cabildo_ had not influenced their decision to conserve their forest.
F. Forest Value
   1. Why forests are valued

Respondents rarely related how biophysical and livelihood factors influenced their reason to conserve; preferring instead to talk about the way they value their forest. Several respondents specifically said deforestation happens because of a lack of knowledge about the value of the forest instead of economic necessity.

Interview analysis indicates forests were valued primarily as a source of forest products and for the ecosystem services they provide—especially water. A smaller portion of conservers connected forest conservation with maintaining their culture and human well-being. A small number also said that forests were important because they provide habitat for wildlife. Conserving forest as a future source of forest products, water production, ecotourism revenue, and other opportunities were frequently given as reasons for conservation. For some households the forest is less important now than it was in the past, because people use eucalyptus for firewood and cooking gas.

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Table 7. Why forests are valued

Non-conservers were more likely to value forests for their forest products. Some even said that forests do not have any value.
The forests practically are not important. In the past we went to them to get timber and charcoal to sell. I'm old, I don't know. In the past they used to be important for clearing, for planting pasture grass, for harvesting firewood. But all of this is changing. Now they are not important. [3021]

Most non-conservers were less extreme. Some even valued forests for the same reasons as non-conservers.

a. Forest Products

Forests were important for both conserver and non-conserver households as a source of forest products, although few of these have commercial value. All non-conservers who still had forested land\(^{10}\) and 88% of conservers harvested at least one product from their forest. The significance of this distribution could not be measured, because 50% of the expected frequencies were smaller than five. More non-conservers (33%) harvested forest products commercially than conservers (12%). This difference could not be tested for significance, because 25% of the expected frequencies were less than five. The most important forest product identified by respondents was firewood, followed by timber. Few respondents valued the forests for other non-timber forest products (NTFP) besides firewood.

Firewood was the primary forest product. Many respondents preferred forest trees to non-native eucalyptus and pine for firewood because it lasts longer. All non-conserver households harvested firewood from their forest. A slightly smaller proportion (74%) of conservers still harvested firewood from their forest. The significance of the difference could not be measured because 25% of the expected frequencies were less than five. No households in either category reported selling

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\(^{10}\) In the forest product section only non-conservers who still have forested land are included in the analysis.
firewood, although two said they sold charcoal when they converted their forest to pasture.

Some said that they did not harvest much firewood from their forests, because it was too far away. Instead they used the much closer eucalyptus and pine that had been planted by NGOs. For many of these respondents firewood from their forest was only used when they were staying in the cerro with their cows. A few respondents also said firewood was less important than in the past, because they now used gas for some of their cooking — which “put the brakes [1004]” on harvesting firewood.

Large quantities of firewood are necessary for celebrating Christmas, Easter and other religious fiestas. The forests, as one respondent pointed out, “are very necessary for fiestas, for Christmas, for cooking during fiestas [1026]”. The host family of major fiestas must feed as many as 200 people (sometimes more than once), so vast quantities of firewood are consumed. The following photograph shows how much firewood was used during one Christmas in just one community.

Figure 17. Firewood for the Christmas fiesta in one community.
This firewood came from the forest, because the hosts prefer cooking with firewood from the forest instead of from non-native pine and eucalyptus.

Timber was harvested from the forest to a lesser degree than firewood, and it was occasionally sold. Sixty-three percent of non-conserver households that still had forest and 56% of conserver households reported harvesting timber from their forest. Again, the significance could not be measured because of small expected frequencies. Most said they rarely harvested timber and when they did it was only in small amounts and they tried not to disturb the forest much when they did.

*Sometimes we cut down one or two trees for firewood and timber, but very little.* [1012]

*We can take out some timber, but without hurting the ecosystem much.* [1001]

I did not witness anyone harvesting timber from their forest so I cannot say how destructive the activity was. As respondents said about firewood, the timber extraction was limited due to distance and difficulty of transportation. A couple of households said the best timber had already been removed from their forested land. Respondents also pointed out that they use a lot less timber (and other forest products) in house construction than they did in the past. Houses built from adobe blocks and/or cement largely replaced the older wattle-and-daub structures.

A small portion of households sold timber. Non-conservers were only a little more likely to harvest timber commercially than conservers. Thirteen percent of non-conservers who still had forest and 9% of conservers sold timber from their forest. Timber enhanced the livelihood security of this conserver household;

*Sometimes the forest helps us economically. When we don't have money sometimes we sell some wood from the forest. We don't sell much and only do it as a last resort.* [1003].
One conserver owns a wood shop that sells boards and furniture. The products are made from pine, but she said customers are always asking for wood from the forest. She said she plans to harvest some timber from her forest to sell, but she emphasized that she would, “not take all of the timber out, because it is so useful”.

Non-timber Forest Products (NTFP), besides firewood, were much less important to respondents than firewood and timber. Thirty-eight percent of conservers and non-conservers reported harvesting NTFP (excluding firewood) from their forests. The respondents who did harvest NTFP from the forest reported doing so rarely. A small portion of respondents valued the forest as a source of medicinal plants. Laurel Myrica spp. is used for ritual cleansing (to get rid of bad air) and to relieve menstrual cramps. Some respondents said they knew many medicinal plants grew in the forests and wished they knew more about them. The second most commonly used NTFP were epiphytic bromeliads. These were used during Christmas to wrap tamales and decorate nativity scenes. A few respondents said they took orchids from the forest to put in their home gardens as ornamentals. Three respondents mentioned harvesting palm fronds Ceroxylon spp. to decorate entrance ways during religious fiestas. Fine hardwoods are also valued for making long lasting furniture, utensils, platters, tools, and backstrap loom parts. Myrcianthes spp., Podocarpus montanus, and Podocarpus oleifolius are the most highly valued of these hardwoods.
Manufactured household products have replaced many handmade ones, but I observed several households that continue using handmade ones for their cultural value. Forest products were also recognized for their use in cultural celebrations. For some respondents, conserving the forest ensured a connection to the more traditional life of the past. These respondents talked about how various forest products went into building houses, weaving traditional clothing, cooking, eating, and celebrating fiestas. Many spoke fondly about the traditional uses of forest products and lamented their declining use.

Only one NTFP was harvested commercially. Three respondents (two conservers and one non-conserver) sold sada – a type of bamboo – to the Otavalo Indians who use it to make panpipes and other items to sell to tourists.

Conservers frequently stated that they were conserving their forest, because they wanted to protect their source of forests products.
Because we need it for a lot of things – for stakes, for wood. We use it a little at a time [1009].

Because it is useful – we take out firewood and posts for the house. That's where the materials are [4002].

Forest products played a role in households' decisions to conserve their forest.

Wildlife was not a highly valued forest resource among respondents with the notable exceptions of the Mountain Tapir and Spectacled Bear. Wildlife was also more likely to be harvested commercially than forest plant products. Respondents reported that body parts of both the tapir and bear have been used medicinally for a long time. Tapirs, in particular, were highly valued.

When people heard that up at Torre\footnote{Torre is the name of one of the sectors within the Saraguro forests.} a tapir had been caught, the whole world went running to ask for hooves, to ask for pieces of meat, because it is medicinal. It's good for asthma and people believe that the hooves are good for women who are about to give birth. For colic (indigestion) too, the stomach of the tapir cures colic.

Three years ago, my husband and some other friends caught a tapir. Afterwards the meat was divided up little by little until every piece had been taken for medicine [3003].

On the rare occasions when a tapir is caught, its body parts are sold to interested community members. Because of the animal's rarity and high value tapir parts are considered to be "carisimol (very expensive!)."

Spectacled Bears were also sold for medicinal purposes. During my two years in Saraguro, I know of four bears that were harvested from the forest. According to a key informant, one cub was sold to a local healer for $50. The healer killed the cub and used its body parts for medicine. One bear was tied up and kept as a pet. Another cub was captured (and its mother killed in the process). According to key informants, the owners of this cub hoped to sell it to a circus for $800.
Interestingly, at least one indigenous person reported the bear’s owners to the Ministry of the Environment. Ministry officials said they did not have the personnel to do anything about the report, nor did they have a place to put a confiscated bear. Word of the report got back to the bear owners, and they moved the cub to a more discrete location.

Birds are also hunted, especially Bearded Guans, which are used for food. Nearly all of the respondents said outsiders do most of the hunting. They said white people come from the town of Saraguro and the city of Loja to hunt up in the forests. Many respondents also claimed that the soldiers from a guard station in the forest frequently kill tapirs and Bearded Guans for meat. A key informant said there used to be a “famous” white hunter from the town of Saraguro who frequently came around the indigenous communities selling wild animal parts – mostly for medicine.

Parrots are popular pets in the Saraguro area – especially among the white population. One respondent from the community of Pichig said her neighbor owns a Golden-Plumed Parakeet that he caught from the forest. According to the Ministry of the Environment most parrots for the pet trade come from other parts of Ecuador.
Firewood was the primary forest product followed by timber. Several forest products have cultural and religious value - especially animals and plants that are used as medicine and for religious festivals. Forest products were rarely sold commercially. Some respondents were conserving their forest to protect their supply of forest products.

b. Ecosystem Services

Many conserver households realized that Saraguro forests needed to be conserved when they came to understand the ecosystem services they provide.

*I have seen here the indiscriminate cutting of the forest. There is no respect. The cutting of the forest causes erosion. People have to migrate to other places. There used to be more rain. Because of the water shortages, agriculture has become more difficult.* [4020]

Forests were valued by both conserver and non-conserver households for the ecosystem services they provide, although conservers were significantly more likely to value the forest for ecosystem services than non-conservers ($X^2 = 4.923, df = 1, p = 0.027$). Eighty-two percent of conservers and 53% of non-conservers said forests were important because of the ecosystem services they provide.
Water production was by far the most commonly mentioned ecosystem service. This function was mentioned as being important by 77% of conservers. Respondents also said forests are important for controlling erosion, producing clean air and wind protection. Respondents saw these services as helping the society as a whole, but also for improving their own lives. They said forests improve productivity and extend the life of their pasture by increasing soil humidity, reducing erosion, and "keeping it warm" by protecting it from wind.

Respondents described the connection between forests and water in several ways. The most common explanation was that forests "call in the rain." Respondents also said forests "attract the rain", "attract water", "produce water", and "purify water".
They said that “without the forest, there will be no winter” meaning that there will be no cool rainy period. Another respondent pointed out that, “in other places where they don’t have forests the summer comes.” The term “summer” was locally used to describe a hot and dry period of time. Many respondents said deforestation reduces rainfall. Conservers frequently said the landscape became drier and water resources diminished after so many forests were cut down.

_The trees above here were huge, but now there is nothing. It’s all pasture and grass. My son says we should not cut our forest. Because now we know about the services the forest provides. It calls in the water._ [1026]

Several respondents described how retaining forest cover above their pasture improves the quality of the grass below. They said retaining some forest at the top of the watershed keeps slopes from drying out below. Four conservers specifically said that their forest provides an ecosystem service to the people who lived down stream. One complained that the city of Loja and another said the town of Saraguro were taking the water produced by their forest.

Oxygen production was valued by respondents, but to a lesser degree than water production. They said the forests both “produce” and “purify” the air.

Some non-conservers also noticed that forests were disappearing and that water was becoming scarce as a result. But most of them had already cut their forest, so it was too late for this new understanding to influence their decision making. This man was one of two non-conservers who regret their decision to clear all of their forest. He said he did not realize the negative consequences for the environment.

_[We cut] to raise cattle….without knowing. We cut because we didn’t understand._ [3002]

Seventy-five percent of non-conservers who still had forest knew that the forest provided ecosystem services such as water and oxygen production, but they planned
to clear their forest for pasture anyway. Many of these non-conservers were in the lowest economic category and made it clear that they did not have other options but to clear their forest. This young father, for example, said, “The forests are very important for water production.” Despite their value, he said he will clear his forest if he has to because, “Cattle production is what sustains us here. It’s all we have” [4001].

Interview responses indicated that the recognition of the ecosystem services provided by forests was a strong incentive for conservation. Water production was the most important service. Producing and purifying air, controlling erosion, and reducing wind were mentioned less frequently than water production. Ecosystem services were valued by smaller number of non-conservers, although some of them may not have known this when they cleared their forested land. For some non-conserver households, economic necessity took priority over the value of the forest for providing ecosystem services. In contrast, the value of ecosystem services took precedence over economic necessity for some of the poorest conserver households as well.

c. Wildlife Habitat

Less than half of the respondents mentioned the forest as being important for providing wildlife habitat, although a strong relationship was found between valuing forest for wildlife habitat and being a conserver household ($X^2 = 7.696$, df = 1, $p = 0.006$). Forty-four percent of conserver households valued the forest for providing wildlife habitat compared to just 6% of non-conservers. Birds were the most frequently mentioned wild animals.
Figure 21. Households valuing forest for wildlife.

This non-conserver explained why forest clearing is not ultimately harmful for birds:

*For the birds there are disadvantages [to forest clearing]. They won't have a place to sit. But when there is still forest in other places, they can just go to other trees to sit on.* [1017]

Just one non-conserver said that the forest was important for providing wildlife habitat.

Comments about the importance of the forest for wildlife were more common among conserver households.

*Wild animals are endangered. That is why we care a lot about conserving the forest.* [4015]
One conserver household no longer allows hunting in their forest because, “Killing a bird is like killing a person” [3001]. Another conserver said the forest is very important to her because it provides wildlife habitat;

“If we don’t have any forest, where will the animals live? [3003].”

For another household, conserving their forest was important, “to purify the air, and to conserve the species of birds more than anything” [3007].

A small portion of households talked about the value of the forest for wildlife, but recognizing this value was correlated to forest conservation.

d. Well-being and Cultural Values

Forests were being conserved by some respondents, because they enhanced human well-being (their own or the society’s) and/or because it helped maintain their indigenous culture.

The forest is very important to me, because I grew up in an area close to the forest. Because of this the forest is very important – especially the birds. I have my years now, but my mind is young thinking about my youth and seeing the birds and everything there [1006].

Comments connecting forests with human well-being were more widespread among conservers than non-conservers, although they were not absent from non-conserver comments. Fifty-six percent of conservers and 24% of non-conservers valued forest for well-being and cultural reasons. This difference was found to be significant ($X^2 = 4.791, df = 1, p = 0.029$).
Figure 22. Households valuing the forest for cultural and well-being reasons.

One non-conserver said that without the forests, life will not be complete.

This respondent was conserving her forest because,

*It maintains a pure and healthy environment. The plants absorb the bad and put out the good.* [1014]

Two conservers said that the forest reduces the occurrence of sicknesses in people.

One of them is a very popular traditional healer. I had to wait over an hour both times I spoke with her as people streamed in and out of her house for her healing services. This suggests that her comments resonate with other people in the Saraguro area.

She went on to say that forests have restorative powers.

*Before I was 48 years old, I didn’t know anything about the forests. It was as if I was dead before I knew nature, but now I am alive. When the forests are maintained people gain life. I think that without the forests*
there are more diseases. The forest cures diseases. They are important for our health.

A common theme through many of the comments connecting forests with well-being and culture had to do with the idea forests and forest products purifying the negative and the evil from people's lives. The most commonly harvested medicinal plant from the forest, laurel Myrica spp.,\textsuperscript{12} is brushed over people's bodies during a common purification ritual. The ceremonies that take place at two different sites in the Saraguro forest are both purification rituals. One of the rituals takes place at the Incan carved bath on the slopes of Acacana.

The water that springs from Acacana is sacred. The Virgen Pugra bath is there. That is where the shamans go. People say you can be cured there [4005].

Figure 23. The Incan carved pool of Virgen Pugra. (photo by Dennis Ogburn).

The forest had spiritual value for several conservers.

If we plant trees they don't grow how God planted them. That is why reforestation cannot replace the forests that God planted. [1026]

My son does not want us to cut the forest - to destroy the Mother Earth. We have to take care of it. It is our blessed Mother Earth. The forest is beautiful. That is where God exists. [2001]

\textsuperscript{12} The laurel tree grows only in the forest. Olson's (2005) study of tree use in Saraguro found only one person who grew the tree in a garden.
Three conservers stated that conserving forests is necessary for maintaining their indigenous culture.

*We cut some forest with my dad to make pasture. But then we came to understand about the history, the importance, and its relation to our culture. And so we said we are not going to cut. In part it was a cultural question. Culturally we have a close relationship with nature. We feel a lot for the mother earth.* [1019]

This woman elegantly made the cultural connection by comparing the forest to the long braid that is a defining feature of Saraguro indigenous identity for both men and women;

*CUTTING the forest IS like cutting our braid. WE have to maintain the forest. IT IS like the indigenous people, IF we cut our braid we are no longer indigenous* [4005].

Efforts to maintain indigenous culture may contribute to conservation, but indigenous identity may also discourage Saraguros from abandoning cattle production. Two of the women who have adopted alternative livelihoods both reminisce about their days raising cattle in the cerro. Another woman said the household supports itself well with off-farm income and only continue to raise cattle out of “custom”.

Respondents, especially conservers, connected forests with human health, spiritual well-being, and maintaining their indigenous identity. Maintaining indigenous culture may also motivate some households to continue raising cattle.

e. Option Values

Many respondents said they were conserving their forest to enhance their security and provide more options for the future, even if they are not benefiting from the forest now.
If I cut a small tree now, there won’t be any timber for future generations. The benefits [of conserving] are the opportunities for the future [3001].

We have to save them because they are useful. If we get rid of all the forests we will lose everything. [4027]

It is important to maintain a clean environment, so that there won’t be water shortages. [4020]

Six conservers said they hoped they could generate income from tourists visiting their forests in the future. As one of them explained, “The forest needs to stay there so that it can be a tourist site – if that is possible. There is a beautiful waterfall there too” [4015].

Respondents indicated that enhancing livelihood security for future generation was an incentive for conserving their forest:

In the future there may not be any forests left. There won’t be any wood – nothing. So we are leaving it for our grandchildren. They can use the wood. It will be a great advantage for them [2001].

If I cut down all of my forest it would be a benefit for me. I could sell the firewood. I would have wood for fences and beams and houses. But I am not going to do this. If I do this, what would happen in the future? [3003]

As she asked this question about the future, this last respondent motioned to her niece sitting in her lap. Respondents also said forests should be conserved so that future generations can know what they are like. Option values proved to be a factor that contributed to conservation for some households.

2. Changing Forest Values

Interview responses indicated that a change occurred in how people value forests.
The whole family wants to maintain them. I believe that now the whole community wants to conserve the forests. Twenty years ago they didn’t respect the forest. The grandparents, the parents, they never knew what would come to pass with the new generation. Now we are better educated.

Other respondents said NGOs helped change people’s minds about the forest. Many said that they saw that the forests were disappearing. They saw the impacts of deforestation on the environment and that changed their minds.

Respondents make it clear that an environmental ethic has evolved among many people in the study communities. How did this happen? What nurtured the development of an environmental ethic?

a. Forest Value among Older Generations

This exploration of changing perceptions and management begins with a look at how older generations valued the forest and what respondents said they learned from their elders. The majority of comments indicate that older generations saw the forest as a place for pasture and they did not realize that the forest would end. This comment was made by a 66-year-old woman.

The elders, for example, we did not realize the damage we were doing to the forest. We said, “Here, where this forest is, I am going to make my pasture”. We were always cutting and cutting the trees. We did not realize. For us the only life we had was clearing the forest and planting pasture. In the past that is how we lived. I lived this way too.

The following 64-year-old conserver described how older generations viewed the forest and how those views have changed,

In 1941, there were still huge areas of forest. The forest was tremendous! There was no comprehension. No one said that the forest would disappear.

We didn’t discover the forest ourselves. People from Cuenca discovered the forest here. Those from Cuenca, the mestizos, came to cut down the Mullón (Podocarpus montanus) and the Romerillo (Podocarpus oleifolius). They started to take them away in 1955. They cut on our land. They told us they were helping us clear the land for
We didn’t know, because we did not realize how important the forests were. Now, that would never be allowed. [4005]

Most respondents said older generations valued the forests for the great variety of products they provided and as a place for pasture. Respondents from three households said older generations knew about the ecosystem services that the forest provided, such as this 57-year-old woman from a non-conserver household:

My grandparents said that when there was no forest there would be a drought. The plants provide humidity and when there is no forest the rain diminishes. [1018]

Responses indicated that although some elders knew the forest provided ecosystem services; these views were not widespread among older generations.

b. Differences in forest views between generations

Noteworthy differences were found between how older and younger generations valued the forest. Since more than one household member frequently participated in answering interview questions, the perceptions of different aged household members came to light. The following exchange demonstrates this point. When asked why the forest is important, the grandfather listed the names of six native tree species and said he used to bring firewood from his forest. He said forest trees, “are good for tables, for doors, and wood for tools”. Then his grandson added that the forest,

is the source of rain. Because of the cutting [of the forest] we don’t have rain. The trees are native to this place. They are becoming extinct. They are also useful for making houses. [2012]

With few exceptions, respondents who were 50-years-old and above were more likely to talk only about utilitarian forest values, such as being a source of firewood and building materials. Younger respondents valued forests for a wider variety of reasons that included ecosystem services, cultural connections, and existence values.
Utilitarian values were not absent from their comments, but these were just one of many forest values. Whereas, older respondents valued forests primarily for their utilitarian reasons.

On several occasions teenage sons and daughters spoke up during interviews to add to their parents’ comments. When they did so, teenagers always talked about the ecosystem services provided by the forest and that it should be conserved. On two occasions teenagers even told their parents how to respond to my questions.

The younger generation appeared to be influencing how their elders manage their forests.

*With my dad, yes we cut. But after we saw the drying out – that there was less water every year, we asked my dad to stop clearing and to plant more. We encouraged him not to destroy the forest anymore.*

This respondent said that her father agrees with them now and has stopped cutting. She said that he now understands the connection between deforestation and the diminishing water supply.

Younger respondents valued forests differently than their parents. They were more likely to consider ecosystem services, while the older generation placed more importance on forest products. These accounts offer further evidence for a change in how forests were valued.

c. Formal Education

Increasing levels of formal education were found to be related to forest conservation. Conservers tended to have higher levels of education than non-conservers. Higher levels of formal education had both a direct affect on conservation by enhancing ecological awareness and an indirect affect by opening avenues for occupational diversification. Many conservers said that formal education had taught
them about the importance of the forest and this knowledge contributed to their decision to conserve.

The differences in education levels between conservers and non-conservers were most pronounced at the upper end of the spectrum. Similar proportions of conservers and non-conservers completed only elementary school or only high school. Twenty-nine percent of conservers and 25% of non-conservers completed high school. A slightly larger portion of conservers (18%) completed only elementary school compared to 13% of non-conservers. At the extremes the differences between the two groups become more apparent – especially at the upper end. Twenty-four percent of conservers attended college, but only six percent of the non-conservers had attended college. More non-conservers were found at the lower end of the education spectrum than conservers. A full 56% of non-conservers had completed only 0-3 years of schooling, while only 29% of conservers had completed that low level of schooling. I was unable to determine if differences in levels of formal education were correlated to forest conservation because 38% of the expected frequencies were less than five.

13 The designation of education level per household refers to the highest level of education of the adult household member who contributed the most to completing the survey which was the head of household in all but three surveys.
Figure 24. Level of formal education.

All respondents were asked how they learned about the forest. Only four non-conservers reported learning about the value of forests in school. The rest of the non-conservers said they learned about the forest from their parents. According to one woman, she and her husband had to cut their forest because they never went to school. Educated people, she said, have other opportunities and are not forced to depend on raising cattle. A 65-year-old non-conserver spoke disparagingly about the impact of formal education as he wove traditional cloth on his backstrap loom.

*Kids go to school today and they study, but they don’t know anything. Sometimes they are dumber than dogs. They don’t know how to cut down trees or make pasture. And they don’t know how to weave.* [3021]

His comments illustrate how formal education can be a disincentive for deforestation.
Conserver households were more likely to say they learned about the forest from school than non-conservers, although many conservers claimed to have learned from non-school sources as well. Several said they learned in elementary and high school that about the ecosystem services that forests provide – especially that plants produce oxygen. A particularly thoughtful conserver said she had not cut her forest, because her formal education taught her about their importance. One conserver learned about the forests while in the agriculture program at the Saraguro High School, which CARE and Peace Corps were instrumental in forming.

This 65-year-old respondent said that increased educational opportunities will have a positive impact on forests,

*I don't have a school education. I can't read or write, because in the past there was no school in the community. Now, thanks to the lord, our children have a school. They have it all. So they know the natural forest and how it should be used.* [2001]

The schools themselves have also changed. A 64-year-old man, who only attended two years of elementary school, said that in the past school teachers did not teach students about the importance of the forests. Now, he said, students do learn this in school. A respondent who started an alternative elementary and high school said he is dedicated to teaching students to “harmonize our lives with nature [1002]” which is a sentiment I saw him put into practice at the school. Another survey respondent, this one a high school principal, said,

*In the high school here, we encourage the students to try to conserve the few forests that are left. We try to motivate students not to cut them down.* [4011]
Figure 25. Elementary students on a field trip to the cloud forest.

At one elementary school’s 2004 Inti Raymi Fiesta, teachers helped their students produce a series of posters explaining their responsibility to protect the environment. According to the posters, this responsibility was handed down by Hatun Pachakamak - a deity that has been worshiped in the Andes for over a thousand of year (D’Altroy 2002). The teachers at this school made an effort to connect environmental stewardship with maintaining their culture.

Increased access to formal education for indigenous people was even influencing people who have not received much formal education. Several respondents said they were learning about the importance of the forest from their children who were more highly educated.

My husband studied the importance of the forest and said we are not going to cut it. My children won’t allow us to cut it or sell it, and they say it would be a good idea to buy more forested land. One of my sons

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14 Austral Winter Solstice and Sun Fiesta
studied in Cuba, and when he returned he would not allow us to kill a single wild animal. [1007]

Non-educational factors were also influencing this woman’s decision to conserve her forest. She added that the household makes money from their general store and that they do not need more pasture. A combination of economic security and increased ecological awareness contributed to her decision to conserve. She was one of several respondents who said that formal education was influencing forest management decisions.

The role of formal education though is not so straightforward, because the three most dedicated and enthusiastic conservers had very little or no formal education. One attended just one year of school, another 2 years of school and the last had never attended school.

These men appeared truly exited to talk about conserving their forest. They were also exceptionally knowledgeable about forest ecology and history. They could name more native tree species than other respondents and recognized the difficulties of forest plant species propagation and regeneration. One of these was the only respondent who was able to differentiate parrots from parakeets. He told me that parakeets eat the seeds of the *mullon* tree (*Podocarpus montanus*)\(^\text{15}\). Another one of the three respondents recounted to me the most in-depth history of deforestation in the area that I heard.

All three of these respondents spoke with passion about forest conservation. As one said, “I really love plants [2001]”. All three men were in their 60s. Two had worked a lot with various NGOs and said they learned about the importance of the

\(^{15}\) Development agents, tree nursery employees, and Ministry of the Environment employees reported that the hard seeds of both *Podocarpus* species are almost impossible to propagate in a nursery. They suspected that the seeds must be treated first by passing through the digestive tract of a parrot, parakeet, toucan, or tapir in order to propagate. Unfortunately they did not know which animal performed this important task. With the exception of the toucan, all of these animals and the *Podocarpus* trees are threatened.
forests through that involvement. One claimed never to have worked with NGOs. He said his son had encouraged him not to cut his forest. The man also said that he decided to conserve his forest when he saw that they were disappearing.

In general, conservers had higher levels of education and were more likely to say they learned about the importance of the forest through formal education than non-conservers. Increased access to education and a greater emphasis on the value of the forest within the school system may help to explain the differences in how generations value the forest.

d. Role of NGOs

A large portion of both conservers and non-conservers had worked with non-governmental organizations from abroad or attended their environmental educational talks. For many of these households, involvement with NGOs helped shape their environmental ethic, which they said contributed to their decision to conserve their forest.

Sixty-two percent of conserver households and slightly fewer, 35% non-conserver households, had been involved with NGOs. No significant difference was found between these proportions ($X^2 = 3.188$, df = 1, $p = 0.074$). These percentages may be somewhat misleading for two reasons. Households from the communities of Lagunas and Gunudel who said they had not worked with NGOs, may have attended educational talks at obligatory *mingas* (communal work days) in the Washapamba Protected Area. Some of the households in these two communities may have learned about the importance of the forest during *mingas* even though they reported no involvement with NGOs. In addition, households that mentioned any involvement with
NGOs were included in these percentages so these proportions do not reflect different degrees of participation with NGOs. Household involvement with NGOs varied greatly. Members from some households attended educational talks, received pine or fruit trees, or helped plant pine trees on communal land. Others worked more extensively, with some becoming paid extension agents for the NGOs, while others organized resource conservation projects with NGOs in their capacity as community presidents.

Respondents mentioned working with or attending talks sponsored by the United Nation’s Andean Mission, CARE-Promusta, Plan-International, Peace Corps, and the local (but internationally funded), Kawsay Foundation. By far the most commonly mentioned NGO was CARE-Promusta.

Respondents said NGOs provided environmental education and technical assistance. Technical assistance revolved around reforestation with non-natives, soil conservation, and intensifying agricultural production (including efforts to encourage the development of commercial agricultural production). A small number of comments regarding NGOs were negative and showed that some households were distrustful of NGOs.

Environmental education initiated by NGOs appeared to have had a strong impact on forest owners. As one conserver said, “The NGOs woke us up about the importance of forests [4005]”.

*There are old people, for example, who are not well-educated. They don’t understand the importance of the forests. But the institutions [NGOs] that existed in county of Saraguro made us in the communities understand the importance of forests.* [1003]

*CARE-Promusta did work that gave some direction and vision to the people to see and to value [the forest].* [1019]

*There used to be talks in the communities about why forests should not be cut. Before this we just cut the forest for our own benefit. But they*
told us that we shouldn’t cut the forest. So we stopped cutting the forest because of the talks that gave us an understanding of the importance. [3003]

These educational talks were sponsored by NGOs. Many conservers said that NGOs influenced their decision to conserve their forest through the organization’s environmental educational efforts.

e. Life experience and history

After a while, we realized that the natural world was disappearing. I thought about it a lot and so I let the forest be. [3006]

Seeing what was happening on the land also contributed to the formation of an environmental ethic. Many respondents were aware of the environmental changes that had occurred since widespread deforestation began 50 years ago. They said they came to appreciate the forest more by seeing the forest disappear and by living in the close to the forest with their cows.

Several conservers talked about how important life experience had been in shaping and changing their views of the forest. This conserver’s experience converting forest to pasture changed his mind and made him realize that the forest needed to be protected,

Since I was a kid I cut the forest with my parents…with axes, machetes and chainsaws. I participated in all of this work. After awhile I started to feel some pain for the trees. We destroyed a lot of forest. It caused me pain to see this zone without vegetation. [1004]

Over and over again respondents said they decided to conserve their forest when they realized what was happening to the Saraguro forests. They came to see that the forests were disappearing and that this had negative impacts on the environment.

We saw that there used to be a lot of water and that the water was running out. We realized that it was because the forest was disappearing. [3014]
We saw that everyone else was cutting. My dad said, let's clear it. We said, "No, the species are disappearing". [4015]

I saw that in the long term, if the people don't take care of the forest, Saraguro will become like Susudel (a highly degraded area to the north) – which is already a desert or other places where the desert is advancing [1002].

Figure 26. Several conservers noticed that these lakes were drying up as a result of deforestation (photo by Dennis Ogburn).

Conservers also noticed that populations of specific animals and plants were declining.

*There used to be the hawk – a big bird – there used to be many, but now I don't see them. The Caracaras are disappearing. There are few now. The parrots, there used to be many in the forests, but not now [1007].*

*There used to be tapirs and bears. My dad and grandparents said they used to see them, but now there is no forest and so they are rare. There aren't any now, but there used to be [1026].*

All of these respondents said that seeing the forests disappear and the negative impacts of that influenced their decisions to conserve their forest.

Forests were valued for a variety of reasons, primarily as a source of forest products and for the ecosystem services they provide. To a lesser extent, forests
were thought to improve human well-being and to be important for maintaining of Saraguro indigenous culture. In many cases forests were being conserved because they could provide forest products and water in the future and improve quality of life for future generations.

A change occurred in how forests were valued. Previously, forests were valued as a source of forest products and as a place to put pasture. Younger generations now value forests for many other reasons beyond just forest products. Higher levels of formal education and NGO involvement played an important role in the development of an environmental ethic. This ethic also grew out of the realization that the forests were disappearing. When they saw the harm that deforestation caused they decided to conserve their forest.

G. Differentiation of the Factors that Contribute to Conservation

While recognizing that a complex set of factors contribute to forest conservation, some factors were more important than others. My research indicates that factors relating to livelihood strategies and how people value the forest were the most significant. Biophysical limitations, cabildo and government influence, and demographic pressures were less important. Specifically, household wealth, occupational diversification (especially off-farm income), ecological knowledge, and the forest’s connection with human well-being and culture offer the most powerful explanation for cloud forest conservation. The following box differentiates the importance of each factor considered in this study.
Differentiation of Factors that Contribute to Saraguro Forest Conservation

A. **Strong contributing factors**
   - Household Wealth: Wealthier households were significantly more likely to conserve their forest and respondents said increased wealth contributed to conservation.
   - Off-farm Income (as a measure of Occupational Diversification): Households with off-farm income were significantly more likely to conserve their forest and respondents said off-farm income contributed to conservation.
   - Forest Valuation: Households that valued forests for providing ecosystem services and wildlife habitat, option values and well-being and cultural reasons were significantly more likely to conserve their forest. Households also said this knowledge contributed to their decision to conserve. Formal education, NGOs, and life experience strongly influenced why forests were valued.

B. **Weak contributing factors**
   - Biophysical Limitations due to Slope and Elevation: Strong contributor to conservation but only affected 29% of households.
   - Labor Scarcity and Rising Wages: Strong contributor to forest conservation but only affected 18% of households.
   - Government Influence: Government regulations or education efforts only contributed to conservation in a limited number of cases.
   - Forest Products: The majority of households with forest, harvested forest products non-commercially (especially firewood). Protecting their source of firewood was frequently given as a reason for conservation. The frequencies were too small for statistical analysis.

C. **Unclear or no impact**
   - Remittances: No direct quantitative or qualitative connection was made between receiving remittances and conservation, but remittances did increase household wealth.
   - Cabildo Influence: Cabildos had little affect on private forest management decisions, except in a very limited number of cases.
   - Commercial Agriculture: Non-conserver households were significantly more likely to engage in commercial agriculture. Respondent comments did not explain this relationship.

D. **Commonly mentioned in literature but not explanatory for Saraguro**
   - Population Growth: High population growth and urbanization nationally increased demand for beef and dairy products, but the majority of households still chose to conserve their forest.
   - Household Size (as a measure of demographic pressure): There was no statistical difference in household size among conservers and non-conservers, nor did any respondents say that household size influenced forest management.
   - Access/Distance: Recently had no affect on decisions to convert forest to pasture. Seventy-nine percent of forested land was located the same distance from settlements as pasture. No respondents said their forest was too far away to convert to pasture, although it did influence forest product extraction. This factor was very influential in the past.

Table 8. Differentiation of Factors Contributing to Conservation (Table adapted from Wunder 2001, p216).
Both livelihood issues and ecological knowledge contributed strongly to Saraguro forests conservation. Wealthier households and those with off-farm income had other options for generating income besides just converting their forest to pasture. Conserver households wanted to protect future sources of water, forest products, and the possibility of generating income from tourism (i.e. option values) to enhance their livelihood security and that of future generations. Ecological knowledge relating to ecosystem services, wildlife habitat, in addition to well-being and cultural connections to the forest provided a powerful incentive for forest conservation. A small number of the poorest households were conserving their forest for reasons relating to ecological knowledge. In general, a combination of both economic security and ecological knowledge were essential for forest conservation.
VI Discussion

A. Overall Considerations: History, Complexity, and an Interdisciplinary Approach
B. The Influence of Population Change
C. Biophysical Limitations
D. Livelihood Strategies
E. Role of Institutions on Livelihood Strategies and Forests
F. Importance of Ecological Knowledge and Values
G. Adaptive Management

Saraguro forests are being shaped by an array of biophysical factors and by people – from individual landowners in the parishes of Saraguro and San Lucas, to consumers in the cities of Loja and Cuenca, up to politicians and bureaucrats in institutions as wide ranging as the Ecuadorian national Government, the International Monetary Fund, and the Catholic Church. This complicated web of influences is further tangled by the unpredictability and, at times, irrationality of human beings. Unraveling the factors that contribute to cloud forest conservation feels like bushwhacking through Saraguro’s forests without a machete. My theoretical framework opens a path through this tangle, by focusing my attention on biophysical limitations to forest clearing, the influences of demographic change, livelihood strategies and institutions, and changing forest values. The use of both quantitative and qualitative methods has been particularly helpful. My quantitative data allowed me to see trends among households and the qualitative data helped me explain the reasons for those trends. Due to the small sample size, it is difficult to generalize beyond these trends.

A. Overall Considerations: History, Complexity, and an Interdisciplinary Approach

My findings illustrate the value of understanding the historical context and of studying a specific place at a specific time. According to Ostrom and Wertime (1995),
this information should be gathered by researchers who are deeply familiar with the place instead of from secondary sources. The examination of the historical context of forest management in Saraguro revealed the appropriateness of studying deforestation instead of degradation. A researcher who lacked an understanding of the historical context may have assumed, incorrectly, that the forests around Saraguro were in a near primary condition.

The exploration of Saraguro’s history (and pre-history) also shows that certain sites have been ritually important to the Saraguros for centuries. The road construction company that mined for rock on the slopes of Acacana would have been well-advised to consider the sacred value of the place before starting their project. Ogburn’s archeological account of Saraguro taught me about the pre-historical roots of Acacana’s sacred power, but I learned from talking with local residents that this still resonates with people today. School teachers showed me the sacred pool on the mountain during a field trip. The time I spent teaching in the local schools impressed upon me the efforts that professors are making to tie environmental stewardship with maintaining their indigenous culture. My friendships with Saraguro residents also gave me access to information about the capture of spectacled bears for medicine and pets. My understanding of Saraguro’s history and the long-term participatory nature of my study enhanced its depth and validity.

Saraguro exemplifies Holling’s (2001) and Berkes et al. (2003) assertion that complexity is a defining feature of social-ecological systems. Recognizing and understanding this complexity is essential for finding sustainable solutions to environmental problems. My findings revealed that several factors influence landowners’ decision to conserve their forest. One respondent [1019], for example, said that occupational diversification, cultural values, ecosystem services provided by
the forest, and his realization that forests were disappearing all went into his decision to conserve his forest. An economic approach that only considered the influence of livelihood issues on forest conservation would have missed out on the important cultural and ecological knowledge components of this landowner's decision.

The complexity of social-ecological systems warrants an interdisciplinary approach. Social science research is particularly important. Becker (1999) who followed the IFRI protocol in her study of cloud forest conservation in western Ecuador suggests that researchers “start with and repeat social science research about local people and their relationships with a forest or resource of concern (p160).” It was shown that forests are associated with healing for many respondents because of the medicinal forest products and spiritual purification that it provides. Efforts to conserve threatened tapirs and bears will need to take their high social value into account in order to be successful. These findings show that social factors can motivate forest conservation, but can also exert pressure on forest resources.

Ostrom and Wertime (1995) caution against offering simple solutions to complex social-ecological problems. Other researchers’ (White and Maldonado 1991, Southgate and Whitaker 1992) claims that poverty contributes to resource degradation appear to be too simplistic. In the Saraguro case, poverty was found to be an incentive for both deforestation and forest conservation. Some households were conserving their forest because they could not afford to cut it down, while other more wealthy households were doing so because they were making money in other ways and so did not need more pasture. This example shows why one-dimensional and generalized explanations are insufficient for understanding forest management.
B. The Influence of Population Change

With the fastest rate of population growth in South America, the pressure on Ecuador’s forests increases. Rising incomes in the country’s urban areas boosts demand for meat and dairy products. According to some authors, steep population growth should provide strong incentives for deforestation (Southgate and Whitaker 1992, Sierra and Stallings 1998). The fact that conservation is occurring in the midst of such rapid population growth means that demographic pressures alone cannot explain forest management decisions. The population growth-equals-deforestation model is too simplistic and deterministic. Explanations for deforestation and conservation need to be more nuanced. My findings revealed that several factors go into forest management decisions. Forest management decisions are influenced by how forests are valued, the diversity of income generating opportunities, and biophysical limitations – not just the number of people in a household and increasing demand for beef and dairy products. This is not to say that population growth is unimportant, only that it alone cannot explain decisions to deforest or conserve.

C. Biophysical Limitations

The fact that about of a fifth of the conserver households own land that is unsuitable for pasture means that at least some of the area will remain forested. Steepness and high elevation offer some of the best protection for Saraguro forests. This kind of protection is less mercurial than all other factors explored in this study. Access improves with the construction of new roads, livelihood strategies evolve over time, government influence shifts with each new administration, forests will be valued in different ways in the future, and all of these things will change how landowners manage their forested land. Slope and elevation ensure a more secure form of
protection. Unfortunately this protection only covers a small portion of Saraguro forests. The future of the rest of the forests lies squarely in the hands of humans.

D. Livelihood Strategies

Household interviews revealed that livelihood issues play a major role in forest conservation. This means that conservation efforts must take these livelihood issues into account when designing conservation strategies. Efforts that focus solely on environmental education cannot curb deforestation if households cannot make money from anything besides clearing forest for pasture or if they are so desperately poor that they cannot afford to leave any of their land out of agricultural production. Occupational diversification (especially in regards to off-farm income generation) was a particularly important contributor to conservation. If households still relied on subsistence agriculture and commercial cattle production, it is unlikely that many could conserve their forest today. In 1984, Belote speculated that occupational diversification among the Saraguros may reduce pressure to convert the remaining forest to pasture. My research presents evidence to support his suggestion.

Many households have increased their market involvement and now earn off-farm income, but they have not abandoned their subsistence base. Doing so would make them too vulnerable to a market they cannot control. A key aspect of the Saraguro livelihood strategy is their strong subsistence base which allows them the freedom and security to experiment with economic diversification.

Although three landowners, who are engaged in off-farm enterprises, reminisced about their former days raising cattle in the cerro, there were many household members that preferred to earn income from off-farm employment instead of raising more cattle on converted forested land. I can only speculate about the
reasons for this preference. Off-farm income may generate more income than raising cattle, or it may be easier than clearing forest and walking up to six hours everyday to tend cattle. It is also possible that household members find the off-farm work more intellectually rewarding (especially those who are teachers) or they enjoy the higher status that some of off-farm employment affords (such as being a county commissioner or the director of a local NGO). The desire to help maintain indigenous culture may also motivate some individuals to pursue off-farm occupations. I observed that many people who were employed as teachers and with NGOs were dedicated to helping Saraguros maintain and adapt their culture in the modern world. Economic needs are unlikely to be the only considerations that motivate Saraguros to seek off-farm employment.

The impact of increased agricultural production on forest management remains unclear. I found no evidence to support assertions (White and Maldonado 1991, Southgate and Whitaker 1992) that conservation follows directly from increased agricultural production. Some Saraguros have increased their agricultural production by growing new crops commercially. Surprisingly, conserver households were significantly less likely to be involved in commercial agriculture than non-conserver households. Households said nothing to explain this relationship. I only measured whether or not households were engaged in commercial agriculture and not the degree to which they were involved - so my methods may have been too crude to uncover what is going on with commercial agricultural production. Another possibility is that the households that engage in commercial agriculture are the poorest and/or are the ones without off-farm income opportunities. They may not have other economic opportunities besides growing crops for sale and converting their forest to pasture. If involvement in commercial agriculture actually signified a lower economic
level, the relationship between commercial agriculture and deforestation may make sense because poverty was shown to cause deforestation in some cases.

Increasing wealth was shown to contribute to conservation, but poverty was also found to be a disincentive for deforestation when households could not afford to clear their forested land. What would happen if the economic level of these poor conserver households rises? The eighteen percent of conserver households that were constrained by labor scarcity issues may clear their forest as soon as they can afford to. In contrast, they may choose to seek off-farm employment instead clearing additional forest for the reasons I stated above.

The Adaptive Renewal Model emphasizes the importance of livelihood security in landowner decision making. Belote (1984) shows that enhancing security was a driving force behind Saraguros' “corn and cattle” livelihood strategy. My findings indicate that efforts to enhance security continue to influence Saraguros’ land use decisions.

Several respondents said they continue to raise cattle because they provide more economic security than off-farm positions. Cattle provide food and daily income from cheese and the animals can be sold in case of emergencies. As some respondents pointed out, off-farm income can be less secure than cattle, especially when the government fails to pay teachers salaries for months on end (as it did three different times during my two years in Saraguro).

Interestingly though, the importance of livelihood security is now motivating people to conserve some of their forested land. Converting forest to pasture is as Wunder (2001) writes, “a perfectly rational strategy” for individual landowners. Conserving some forest is becoming a “rational strategy” for many households; because it enhances their security, maintains diversity in their land holdings, and
leaves options open for the future. Conserving forest enhances security by providing a source of forest products for the future. Many Saraguros are concerned that the national government will bow down to pressure from the International Monetary Fund to cut cooking gas subsidies. If this happens, landowners can count on having a secure source of firewood from their conserved forest. Because of the ecosystem services that forests provide, many landowners realized that conserving their forest will ensure future water supplies. Leaving some forest above their pastureland improves the quality of their pasture and extends its life by increasing soil humidity, reducing humidity, and reducing wind. For these reasons conserving forest has become part of Saraguro’s long-term efforts to enhance their livelihood security.

E. The Role of Institutions on Livelihood Strategies and Forests

Neither the cabildo nor the national government directly influenced private forest management much. The cabildos were generally considered to lack jurisdiction over private lands. National regulations prohibiting the clearing of forested land without a permit were known to some landowners, but these laws did not hold much sway over how landowners manage their forest. The Environment Ministry lacks the resources to enforce the rules. Beyond just a shortage of resources, the national government also lacks the confidence of its citizens. Corruption infects all levels of government in Ecuador (at times even community level cabildos), which fosters distrust of the government among its citizens. Instability has been the norm throughout the last decade and the country is frequently paralyzed by strikes and political infighting. In light of these difficulties, it is unlikely that government regulations will provide an effective tool for widely protecting forests any time in the near future.
That said, government regulations may be a disincentive for deforestation in a very limited number of cases. The government prohibition on cutting scared at least one Saraguro household into protecting their forest. The prohibition was also used successfully by the Pichig cabildo to stop the road construction company from clearing forest.

It is possible that the cabildos could organize to halt forest clearing in the future. If this does occur, it will probably be limited in scope. Belote (1978) describes how the cabildos were specifically organized in a way that limited their power; out of fear that the institutions would gain too much control over individuals. Positions in the cabildo are held for only one year, which curbs the power of elected officials. One year terms also limit institutional memory within the cabildo; thereby making it harder for cabildo projects to gain momentum. One key informant said corruption within the cabildos has created distrust among community members. Both the corruption and distrust, he said, would make their conservation efforts unsuccessful.

The cabildos contributed to private forest conservation by providing a forum for environmental education efforts sponsored by NGOs. The forums provided opportunities for community members to come together to discuss natural resource management. In the communities of Lagunas, Gunudel, and Pichig, community leaders encouraged others to conserve their forested land. This gave people with status an opportunity to influence others to change their forest management. The cabildo meetings created a formal avenue for community members to exchange information and learn from each other. Providing an arena for the diffusion of innovation may have been the cabildos most powerful influence on forest conservation. Beyond providing environmental education and a forum for discussion
about natural resource management, *cabildos* may be unsuited for managing larger efforts to encourage private forest conservation at this time.

Although most Saraguro households said government institutions did not influence land management, its policies indirectly affect Saraguro forests in several ways. Dollarization, for example, is making cattle production less profitable, because cattle can now be raised more cheaply in Peru. Imported Peruvian cattle undercut Saraguro producers. If this continues some landowners may reconsider their plans to convert their remaining forest to pasture.

Petroleum extraction (and the large loans it brought into the country) has had several impacts on Saraguro forests. Investments in the education system and improvements in the road system brought economic growth and diversification. As a result many Saraguros were able to adopt alternative occupations which certainly contributed to forest conservation.

The petroleum industry also reduced dependency on the forests for firewood, because the government began subsidizing cooking gas. Belote and Belote (2005) assert that bottled gas slowed the rate of destruction; a view that was supported by several households. Belote and Belote recognize that it had little influence on conversion of forest to pasture. Conversion to pasture, though, is by far the most significant cause of deforestation in Saraguro. Reducing dependency on forests for firewood may eliminate an important value of forests. My findings indicated that some conservers were conserving their forest to protect their source of non-commercial firewood and other forest products. Wunder (2001) argues that benefiting from the harvest of non-timber forest products can provide an effective incentive for conservation. Forests’ value as a source of non-commercial firewood may be an incentive for conservation. (My findings cannot speak to the impact of commercial
firewood harvesting on Saraguro forests.) The International Monetary Fund is pressing Ecuador to reduce cooking gas subsidies which would probably increase firewood harvesting from the forest, although it may provide an incentive for conservation by increasing the value of the forest as a source of firewood.

Government investments in the road system contributed to deforestation throughout the country. In Saraguro, large-scale deforestation only occurred after the construction of the highway connected the area to urban markets. Investments in the road system improved regional integration; the aim of which was economic development (i.e. economic growth and diversification, as well as poverty reduction) (Wunder 2001). Economic development can contribute to both deforestation and conservation. Higher incomes increase demand for luxury food items such as meat and dairy (Wunder 2001) and this greater demand provides an incentive for deforestation. In Saraguro, wealthier households were significantly more likely to conserve their forest. In part because of this economic development, Saraguros can now make a living in a wide variety of ways besides by just converting forest to pasture. This occupational diversification, which came about to a certain extent as a result of government economic policy, contributed to the conservation of Saraguro’s forests.

Non-governmental institutions had some positive, some negative, and some ambiguous impacts on Saraguro forests. Quantitative analysis showed that conserver households were not more likely to have worked with NGOs than non-conserver households. My qualitative data revealed a different story; finding that many households were conserving their forests because NGOs had taught them about their importance. This contradiction may be a result of poor interview design. I asked each household if NGOs had influenced their land management. I suspected that some
people did not understand my question because of how it was worded. According to key informants almost everyone in two of my study communities had listened to environmental education talks sponsored by the NGOs. Although many households were conserving their forest because they understood how valuable it was, they may not have realized that they gained this ecological knowledge from NGOs. In addition my study did not measure the degree of involvement with NGOs.

Conserver comments clearly illustrate the positive influence NGO sponsored environmental education had on forest management for many households. Environmental education by NGOs emphasized the importance of forests for providing environmental services. Many households emphasized the hat the NGOs had awakened them to the value of the forests. The prevalence of this knowledge suggests that the international NGOs were successful at educating landowners about the value of forests. This ecological knowledge was strongly correlated with forest conservation.

NGOs also had negative impacts on Saraguro forests. The large-scale planting of pine plantations may be the most detrimental. Pine plantations were established in places where native monte flourished and they prevented monte from regenerating. If left alone, the monte may have grown into native cloud forest. Monte is composed of a great variety of native shrubs. Many of the same genera grow as trees in the forest. Monte provides habitat for a wide array of birds. Monte is one of the best places to see hummingbirds around Saraguro. I only recorded three species of birds in pine plantations during 27 months in Saraguro but over twenty species of birds in the monte. Epiphytes readily grow on monte vegetation which have been shown to play an important role in water production in cloudy areas (Bruijnzeel and Proctor 1995, Becker 1999, Attaroff and Rada 2000). These epiphytes cannot easily grow on
rough pine bark which means that they may not perform the same watershed function as native vegetation. Some Saraguros also say that pine dries out the soil (Olson 2005), which households never said native vegetation does. Key informants also said that they prefer firewood from the *monte* instead of from the pine plantations.

Despite the negative aspects of pine, and other non-native trees promoted by NGOs, many households use them for firewood and timber. Olson (2005) found that eucalyptus was used more by people in Saraguro than any other tree (native or non-native). This can be explained in part by the fact that the non-native trees are usually more accessible than forest trees. It is unclear to me whether the planting of non-native pine trees contributed to conservation by reducing extractive pressures on the forest or if they made conservation less likely by reducing the forest's value as a source of firewood and timber.

**F. Importance of Ecological Knowledge and Values**

Both the IFRI and Adaptive-Renewal frameworks emphasize the importance of understanding how natural resources are valued and understood by local people (Ostrom and Wertime 1995, Holling 2000, Berkes et al. 2003). How forests were valued by households was found to be particularly relevant for explaining factors that contribute to conservation. Respondents' views of the forest were overwhelmingly positive. A few respondents said the forest was unimportant, but no one regarded forests negatively. Many conservers were passionate about Saraguro forests and their conservation. Forests were valued for both utilitarian and non-utilitarian reasons.

Intact forests do not directly contribute much to Saraguros' livelihood strategies. During the last century, they have become less important as a source of forest products as a result of bottled gas, reforestation with non-natives, changes in house design (to ones that require little or no forest products), and the introduction of
manufactured household items (such as plastic buckets and non-traditional clothing). The decline in the importance of forests products may also be related to the fact that they are farther away from settlements than they used to be. Despite their declining use, the majority of households still harvest at least one product from the forest – usually firewood. There are still people who carve spoons and platters from forest wood, make baskets from various types of bamboo from the forest, and use *Myrica* leaves for spiritual cleansing ceremonies. Continuing to use traditional forest products has become part of some household’s efforts to maintain their culture.

My findings identified a tension in the influence of culture on Saraguro forests. On one hand, households were conserving their forest for their cultural value (traditional forest products, sacred sites, and spiritual cleansing). On the other hand households may in the future continue to convert them to pasture because the custom of raising cattle has been absorbed by the culture. The use of tapirs and bears for traditional medicine also has strong cultural meaning. The fact that both of these animals are now threatened indicates that the harvest has been unsustainable. The use of tapir and bear medicine is so old, that it is unlikely to die out easily. Demand for medicinal wild animal parts may even increase as people try to connect with traditional healing practices from the past.

Efforts to maintain indigenous culture have some negative implications for Saraguro forests, although my findings indicate that the cultural influences are mostly positive.

Knowledge about the ecological value of forests was found to be particularly influential in household decisions to conserve. Becker (1999) argues that, “a broader or more compete perception of the total economic value of forests appears to be a prerequisite for creating local rules and institutions that sustain these woody
ecosystems and their biological diversity” (p160). Ecological value of the forest is an essential component of their total economic value. My findings suggest that some ecological knowledge is a prerequisite for forest conservation (except for when biophysical limitations or labor scarcity issue prevent forest clearing). Although economic considerations were found to be important, ecological knowledge is at least as important. Wealthy households have little incentive to conserve their forest if they do not understand their ecological value.

Most respondents said that ecological knowledge and the value of forests had the strongest impacts on their management decisions. Despite such comments, care should be taken when assessing the role of knowledge and values. Knowledge about the value of forests alone does not appear to be strong enough to ensure forest conservation. Many non-conservers knew that forests were important for the forest products and ecosystem services they provide, but were still planning to convert their forested lands to pasture. While many conservers emphasized the importance of ecological knowledge and values, livelihood issues clearly influenced their decisions as well. It is possible that higher levels of economic security gave some of these households the luxury to seriously consider forest values that do not affect them directly such as ecosystem services. I will argue that both economic wellbeing and ecological knowledge are essential for conservation to occur.

G. Adaptive Management

My findings reveal that a change has occurred in how respondents value and manage their forests. This change has occurred in part because they have seen that forests are becoming rare and that this could have negative impacts on their lives. They have also learned from NGOs and in schools and universities. They probably
also learned from watching and communicating with each other. No respondents mentioned that other community members influenced their decisions to conserve, but I did not ask them directly about the informal influence of other community members. Many Saraguros landowners are adapting their land management practices to reflect what they have learned about the importance of forests. Holling (2001), Berkes and et al. (2003) describe the ability to adapt in times of crisis and change to be an essential component for sustaining social-ecological systems.

Saraguros have shown themselves to be adaptive in their responses to crisis and change. They responded to the crisis created by the Spanish Conquest, by arguing that the only way they could man the way station in town was if they maintained control over their lands. They also adopted useful elements from the Old World such as cattle and sheep, while maintaining ones from Incan times such a corn and potato production. On the other side of the continental divide, in the Parish of San Lucas, residents learned how the judicial system of the new Ecuadorian government worked and then successfully used it to regain control over the hacienda lands. This land reform occurred in San Lucas over 100 years before it happened in the rest of the country and it shows how adept the Saraguro have been at adapting to crisis. The construction of the Pan-American Highway created great changes in the region as well. The Saraguros again adapted their livelihood strategy to take advantage of these changes, by increasing cattle production and entering the cash economy.

As widespread deforestation occurred in Saraguro, many households realized that another crisis was drawing near – this time an environmental crisis. Some are now adapting their livelihood strategy by deciding to conserve some of their forest in recognition of the environmental changes they see around them. This restructuring includes conserving some of their forest in order to maintain their resiliency.
Conserving forest keeps options open for changes that may come in the future – such as ecotourism, end to gas subsidies, timber harvesting in cases of emergency. They also realize that conserving their forest ensures future water supplies and maintains diversity in their landholdings. By conserving their forest they are maintaining their capacity to adapt and change.

My findings exemplify the how adaptive management contributes to sustainable land management as described by the Adaptive-Renewal Model (Holling 2000, Berkes et al. 2003). Adaptive management requires understanding the impacts of land management and then adapting future management based on what has been learned from previous management experience.
VII Conclusion

There are several reasons why it is important to understand the factors that contribute to cloud forest conservation in southern Ecuador. The forest to the south and east of the town of Saraguro provide valuable habitat for a variety of endemic and/or threatened animals and plants. It produces water that is used by thousands of urban and rural residents of southern Ecuador. Saraguro forests also provide firewood, timber, and other products. The forests also have some ecotourism potential.

Processes of deforestation and degradation have probably occurred throughout the last 1500 years of permanent human occupation. Since the Pan-American Highway was constructed through the area 50 years ago, landowners have cleared large areas of forest for raising cattle. When my research began in 2002, most of the Saraguro cloud forests were gone. Despite strong incentives to convert forest to pasture, some Saraguros are conserving their remaining forest. My study sought to understand the factors that contribute to cloud forest conservation. I conducted household interviews, wealth-ranking matrixes, key informant interviews, and 27 months of direct observation to answer this question.

My research was shaped by the IFRI (Ostrom and Wertime 1995) and Adaptive-Renewal frameworks (Holling 2000, Berkes et al. 2003) which recognize the complexity of social-ecological systems. They suggest using an interdisciplinary approach that includes both quantitative and qualitative research. These frameworks encouraged me to examine livelihood strategies, biophysical limitations, the role of institutions, forest value and use, and how these factors have changed over time.
Seventy-two percent of the 60 households that participated in the study were planning to conserve their forest. A complex set of factors were found to influence their decision to conserve.

About a fifth of the households were conserving their forest, because it was too steep or too high in elevation to be suitable for pasture. Biophysical limitations due to long distances and difficult access were found to be less important, probably because cattle are a mobile commodity that can walk to road heads. Forested land up to a six hour walk from primary settlements was considered suitable for pasture. The majority of households (79%) could convert their forest to pasture, which means that they were conserving it for other non-biophysical reasons.

Livelihood strategies were useful for understanding forest conservation. Wealthier households and those with off-farm income were significantly more likely to conserve their forested land than poorer households and those that depended solely on cattle production and agriculture. In contrast to this trend, some households were conserving their forest because they were too poor or too old to convert it to pasture. The process of forest conversion is difficult and expensive. Widespread adoption of alternative occupations has also reduced the labor supply available for clearing forest. This study did not demonstrate that increased agricultural production contributed to conservation.

The government had little impact on how private landowners managed their forest. *Cabildos* did not have jurisdiction over private land, although they played a role in educating community members about the value of the cloud forest. On one occasion, a *cabildo* worked with the government to stop an outsider from clearing forest on private land. Both institutions have some potential to play a bigger role in future conservation but problems relating to corruption, lack of resources, and
management issues will likely prevent those institutions from effectively preventing forest clearing under present conditions.

Forests were valued for a variety of reasons and their value provided incentives for conservation. Many households were conserving their forest as a source of forest products and because they provided ecosystem services, wildlife habitat, option values, and contributed to human well-being and culture.

The forests were not valued for all of these reasons in the past, but an environmental ethic evolved over the last 30 years. This was largely a result of increases in formal education, environmental education by NGOs, and life experience. Many landowners decided to conserve their forest after seeing the negative affects of deforestation for themselves. This type of adaptive land management comes out of a long tradition among the Saraguros of adapting to crisis and change. Today, retaining some forest has become part of a strategy to enhance livelihood security.

The most important contributing factors to conservation are household wealth, off-farm income, and the degree of ecological knowledge. Resolving livelihood concerns is essential for conservation, but ecological knowledge and an environmental ethic are equally important. Households are not going to conserve their forest if they do not value it – no matter how wealthy they are. If people do not understand that the forest produces water, improves their pasture, or is important for their culture (or some other reason), they will have little incentive to conserve it.

My respondents emphasized the importance of ecological knowledge and values. These were the most influential factors for most of them – more so than livelihood factors. Ecological knowledge is certainly crucial, but caution is warranted. Conservation efforts that focus solely on environmental education cannot curb deforestation, if households cannot make money from anything besides forest clearing.
or if they are so poor that they cannot afford to leave any of their land out of agricultural production. This means that both livelihood factors and ones relating to ecological knowledge need to be addressed for conservation to occur.

Conservation efforts are more likely to be effective if they enhance both ecological knowledge and economic well-being and diversity. Addressing only one of these factors may be insufficient.

Economic diversification and poverty reduction should be promoted by development agencies and conservation organizations. This could be achieved in part by increasing access to formal education and improving the education system. Small business loans and technical assistance to help people run the businesses may also help achieve these goals. Promoting ecotourism is a possibility, although it would require a lot of work. In Saraguro there is widespread interest in ecotourism, but little understanding about how to do it. Establishing ecotourism would require training for people interested in tourism. It needs to be initiated on a small scale and probably on the level of individual landowners.

The feasibility of payment for environmental services might also be considered. This could provide a strong incentive for conservation by generating an alternative income for households. Monitoring compliance and establishing a payment system would be challenging.

Efforts to diversify livelihoods and reduce poverty should be made in concert with efforts to educate landowners about the value of forests. NGOs could play a role in this by sponsoring and carrying out environmental education. Environmental education could take place in cabildo meetings, schools, and churches. The radio is a particularly cheap and effective medium for environmental education.
Local studies about ecology and the impacts of deforestation and degradation should also be conducted. For example, the studies could examine propagation of seeds in tapir feces to understand their role as seed dispersers and how many tapirs are removed from the forests annually. Studying the forest’s role in water production would also be valuable. The participation of local landowners, students, and others to participate in the studies (and following education efforts) should be encouraged, although the participants would need to be trained. Offering some kind of payment for help with the research may ensure more dedicated participation. It is essential that the results of these studies are shared with locals. The aim should be educating locals about the forests, instead of publishing the results in a scientific journal in the north. Besides increasing ecological awareness, these efforts could also teach local participants valuable skills.

What does the future hold for Saraguro forests? With ecological awareness and economic prosperity and diversity, the forests may continue to provide benefits for future generations of humans and animals alike. This respondent is hopeful about the future of her forested land:

*Perhaps my children will cut it, perhaps they won't cut it. I believe that they will maintain it, because they realize that the forest is important. They understand.*
### VIII Appendixes
#### A. Saraguro Cloud Forest Products

<table>
<thead>
<tr>
<th>Family</th>
<th>Genus</th>
<th>Local Name</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actinidiaceae</td>
<td>Sauramia tomentosa</td>
<td>Chaguarchero Negro</td>
<td>Loom parts, carrying embers of fires,</td>
</tr>
<tr>
<td>Araceae</td>
<td>Anthurium</td>
<td>Tapra</td>
<td>Wrapping tamales and fish, ornamental</td>
</tr>
<tr>
<td>Araliaceae</td>
<td>Schefflera</td>
<td>Pumamaki, Plantanillo</td>
<td>Spoons, platters</td>
</tr>
<tr>
<td>Arecalesae</td>
<td>Ceroxyylon</td>
<td>Ramos</td>
<td>Fiestas</td>
</tr>
<tr>
<td>Bromeliaceae</td>
<td>Wicundo</td>
<td>Tushiko</td>
<td>Firewood, fence posts, live fences</td>
</tr>
<tr>
<td>Cunoniaceae</td>
<td>Weinmannia</td>
<td>Sarar, Sara cashcu, cashko</td>
<td>Firewood, timber, furniture, houses, platters, bark for cheese molds (in the past)</td>
</tr>
<tr>
<td>Cyatheaceae</td>
<td>Cyathea</td>
<td>Ilhashipa, tree fern</td>
<td>Posts, construction, plant holders, firewood (long lasting), charcoal for firing ceramics</td>
</tr>
<tr>
<td>&quot;</td>
<td>?</td>
<td>Llashin (small fern)</td>
<td>Covering cheese for transport</td>
</tr>
<tr>
<td>Compositaceae</td>
<td>Vallea</td>
<td>Sacha Capuli, Perelillo</td>
<td>Loom parts</td>
</tr>
<tr>
<td>Ericaceae</td>
<td>Cavendishea, Vaccinium</td>
<td>Joyapa</td>
<td>Edible fruit</td>
</tr>
<tr>
<td>Gramineae</td>
<td>Chusquea</td>
<td>Chincha</td>
<td>Traditional drum stick, forage for cattle and guinea pigs, beds (in the past), firestarter</td>
</tr>
<tr>
<td>Guttiferae</td>
<td>Clusia</td>
<td>Duco</td>
<td>Firewood, timber, clothes hangers</td>
</tr>
<tr>
<td>Laureaceae</td>
<td>Persea</td>
<td>Pakaro</td>
<td>Plow</td>
</tr>
<tr>
<td>Meliaceae</td>
<td>Cedrela</td>
<td>Cedro</td>
<td>Timber, firewood, posts stakes</td>
</tr>
<tr>
<td>Myricaceae</td>
<td>Myrica</td>
<td>Laurel</td>
<td>Medicine for purification rituals, saunas, and tea. It is used to build energy, reduce stress, worries and nerves. Creates positive energies.</td>
</tr>
<tr>
<td>Myrtaceae</td>
<td>Myrcianthes</td>
<td>Wawel</td>
<td>Timber, loom parts, spoons, bowls, firewood, charcoal, edible fruit</td>
</tr>
<tr>
<td>Podocarpaceae</td>
<td>Podocarpus montanus</td>
<td>Mullón</td>
<td>Firewood, posts, timber, furniture, house construction</td>
</tr>
<tr>
<td>&quot;</td>
<td>Podocarpus oleifolius</td>
<td>Romerillo</td>
<td>Firewood, timber, furniture, house construction</td>
</tr>
<tr>
<td>Rubiaceae</td>
<td>Cinchona</td>
<td>Cascarilla, quina, uritusinga</td>
<td>Firewood, medicine for allergies, kidneys and other illnesses</td>
</tr>
<tr>
<td>Winteraceae</td>
<td>Drimys or Nectandra</td>
<td>Canelo</td>
<td>Firewood, timber, loom parts</td>
</tr>
</tbody>
</table>
B. Birds Observed in Saraguro During Research Period

Endemic species are written in bold. Endemic designation follows Ridgely and Greenfield (2001b)

**Vulnerable**

Red-Faced Parrot *Hapatopsittaca pyrrohops*
Golden-plumed Parakeet *Leptosittaca branickii*
**Bearded Guan** *Penelope barbata*

**Near-threatened**

Gray-Breasted Mountain Toucan *Andigena hypoglauca*

**Non-threatened Species**

Mountain Caracara *Phalcoboenus megalopterus*
**Carunculated Caracara** *Phalcoboenus carunculatus*
American Kestral *Falco sparverius*
Variable Hawk *Buteo polysoma*
Black-Chested Buzzard Eagle *Geranoaetus melanoleucus*
Band-winged Nightjar *Caprimulgus longirostris*

White-collared Swift *Streptoprocne zonaris*

**Rainbow Starfrontlet** *Coeligena iris*
Buff-winged Starfrontlet *Coeligena lutetiae*
**Flame-Throated Sunangel** *Heliangelus micraster*
Amethyst-throated Sunangel *Heliangelus amethysticollis*
**Purple-throated Sunangel** *Heliangelus viola*
Glowing Puffleg *Eriocnemis vestitus*
Sparkling Violetear *Coilbri coruscans*
Great Saphirewing *Pterophanes cyanopterus*
Purple-backed Thornbill *Ramphomicron microhynchum*
Tyrian Metaltail *Metallura tyrianthina*
White-bellied Woodstar *Chaetocercus mulsant*
Chestnut-Breasted Coronet *Boissonneaua matthewsii*
Shining Sunbeam *Agleactis cupripennis*

Masked Trogon *Trogon personatus*
Powerful Woodpecker *Campephilus pollens*
Crimson-mantled Woodpecker, *Piculus rivolii*
Tourquoise Jay *Cyanolyca turcosa*

Strong-billed Woodcreeper *Xiphocolaptes promeriopirhynchus*
Montane Woodcreeper *Lepidocolaptes lacrymiger*

Azara’s Spinetail *Synallaxis azarae*
Pearled Treerunner *Margorornis squamiger*
Streaked Tufted Cheek *Pseudocalptes boissoneautii*

Chestnut-crowned Gnateater *Conopophaga Castaneiceps*
Chusquea Tapaculo *Scytalopus parkeri*

Cinnamon Flycatcher *Pyrrhomyias cinnamomea*

**Jelski's Chat-Tyrant** *Ochthoeaca jelkii*

Rufous-breasted Chat-Tyrant *Ochthoeaca rufipectoralis*

Black-throated Tody-tyrant *Hemitriccus granadensis*

Dusky-capped Flycatcher *Myiarchus tuberculifer*

Dusky Piha *Lipaugas fuscocinereus*

White-banded Tyrannulet *Mecocerculus stictopterus*

White-tailed Tyrannulet *Mecocerculus poecilocercus*

White-throated Tyrannulet *Mecocerculus leucophrys*

Smokey Bush-tyrant *Myiotheretes fumigatus*

Red-crested Cotinga *Ampelion rubrocristatus*

Brown-bellied Swallow *Notiochelidon murina*

Mountain Wren *Troglodytes solstitialis*

Great Thrush *Turdus fuscater*

Black-Chested Mountain Tanager *Buthraupis eximia*

Hooded Mountain Tanager *Buthraupis montana*

Lacrimose Mountain Tanager *Anisognathus lacrymosus*

Scarlet-bellied Mountain Tanager *Anisognathus igniventris*

Golden-Crowned Tanager *Iridosornis rufivertex*

Masked Flowerpiercer *Diglossops cyanea*

Capped Conebill *Conirostrum albifrons*

Black-headed Hemispingus *Hemispingus verticalis*

Blue-and-black Tanager *Tangara vassorii*

Rufous-chested Tanager *Thlypopsis ornata*

Rufous-crested Tanager *Creurgops verticalis*

Gray-headed Bush Tanager *Cnemoscopus rubrirostris*

Brown-bellied Swallow *Notiochelidon murina*

Plushcap *Catamblyrhynchus diadema*

Black-crested Warbler *Basileuterus nigrocristatus*

Spectacled Whitestart *Myioborus melanocephalus*

Pale-naped Brush Finch *Atlapetes pallidinucha*

Rufous-naped Brush Finch *Atlapetes latinuchus*

Chestnut-capped Brush-finch, *Buarremon brunneinucha*

Northern Mountain-Cacique *Cacicus Leucoramphus*
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