

The Link between Cloud Forest Conservation and Community Benefit : The Roles of Resplendent Quetzal (*Pharomachrus mocinno*) and Aguacatillo (*Persea caerulea*)

Introduction

From April to June 2006, I had a great experience in the cloud forest in Cerro de la Muerte located in the pacific slopes of the Cordillera de Talamanca in Costa Rica (pictures 1~9). It is a region filled with dense forests which are mostly covered with clouds (picture 1). It contains a lot of animals and plants which cannot be seen anywhere else in the world. Utilizing the unique environment, local people have developed ecotourism. I worked in one of the private ecolodges called Iyök Ami located in Cerro de la Muerte. Their objective is to promote conservation and village development with local people. Details of my jobs included 1) cleaning the trails and giving a tour, 2) maintaining organic gardens and the green house, and 3) identifying plant species and making some signposts of plants for the eco-tour.

While working on the project, I found out that a bird called quetzal (*Pharomachrus mocinno*) is culturally significant for local people (picture 2 and picture 20). Quetzal is well known

because of its beautiful green feathers. A male has a red breast and belly and its tail is up to 1 meter long. Females have a brown breast and belly and shorter tails (Johnsgard 2000). Because of its beauty, quetzal has been considered sacred for a long time (Maslow 1986).

Quetzal is attracted by the fruits of a wild avocado tree called aguacatillo (*Persea caerulea*) (picture 3). Aguacatillo grows at high elevations, low temperatures, and a lot of moisture (Whiley et al 2002). Being loved by people, quetzal became a national bird of Guatemala. However, because of environmental change, quetzal is under the threat in some parts of Guatemala. World wide, it is on the endangered species list (Nagel 1999).

The cloud forest of Cerro de la Muerte is one of the few places in the world that quetzal can be seen. Using this as an advantage, local people opened ecolodges. There are a lot of ecolodges containing the word "quetzal" in the name of the ecolodges. A lot of people from other countries come to the ecolodge to see quetzal. In front of the lodge that I stayed, there are two aguacatillo, which have become a good viewpoint to see quetzal. We got visitors from other Latin American countries, the United States, Europe and Japan. Local people can get economic benefit from ecotourism while protecting their

environment.

I believe quetzal and aguacatillo are the key species in the cloud forests in Cerro de la Muerte because they are biologically and culturally valuable. This value contributes to ecotourism, which eventually becomes of economic benefit to local people. In this paper, I examine how the cloud forest conservation and community benefits are related. In this process, I focused on if quetzal and aguacatillo could be key species.

Objectives

I want to investigate how the cloud forest conservation, the quetzal and aguacatillo, and community benefit from ecotourism are inter-related.

In this paper, I approach the research question in five different perspectives:

- 1) characteristics of cloud forests

Definition of cloud forests. Definition of biodiversity.

- 2) the relationship between quetzal and aguacatillo

Distribution and habitat of quetzal and aguacatillo.

- 3) the cultural values of cloud forests

How indigenous people use cloud forest

- 4) the economic value of cloud forests

Definition of ecotourism. How ecotourism has developed.

- 5) the policy of the Costa Rican government regarding cloud forests

What is the government policy regarding cloud forests?

- 6) summary and discussion

How will the cloud forest be managed in the future?

Methods

In order to approach the objectives "to investigate how the cloud forest conservation, the quetzal and aguacatillo, and community benefit from ecotourism are inter-related", the case study strategy is used. A case study is used when a "how" or "why" question is being asked about a contemporary set of events, over which the investigator has little or no control (Yin 1989). This study is based on the observation of the relationship between quetzal, aguacatillo and humans. The study site is the ecolodge in Cerro de la Muerte in the Cordillera de Talamanca in Costa Rica. This study is single-case (analogous to single experiment) with a Holistic (single unit of analysis) case design (Yin 1989).

In Part 1, characteristics of cloud forests, the definition and classification of cloud forests are determined from the literature. In part 2, the relationship between quetzal and aguacatillo, both the historical and biological relationship between quetzal and aguacatillo, are explored. In addition to the literature, my experiences, observations and interpretations help make up Part 3 along with the cultural value of quetzal and aguacatillo, and in Part 4, the local value of quetzal and aguacatillo is discussed. In Part 5, the policy of the Costa

Rican government regarding the cloud forest, I determined from a series of reports.

Study Area

Fig 1. Costa Rica (Google map)



Fig 2. Cerro de la Muerte (CREN MAP)

The Pacific slope of the Cordillera de Talamanca. Located 71km south from the capital, San Jose



Fig 3. Cerro de la Muerte is located in Los Santos Forest Reserve (Kappelle 2000)



Background Information

Geographical Features

Costa Rica is located in Central America with the Caribbean Sea to the east, the Pacific Ocean to the west, Nicaragua to the north and Panama to the south (Fig 1). There are beautiful emerald coasts. The mountains are impressive, and they contain numerous rivers and waterfalls. There are a lot of volcanoes, some of which are active. There are lush tropical forests all over the country.

The mountain ranges in Costa Rica are a part of the Sierra Madre, which lies in Central America. The Guanacaste Mountain Range and Tilaran Mountain Range are located north of the capital, San Jose. The Central Mountain Range and Talamanca Mountain Range (called the Cordillera de Talamanca) are located to the south of San Jose. The Cordillera de Talamanca is the largest, and the most biologically diverse (Fig 2 and Fig 3). It contains Cerro Chirripo in the central part (picture 19). The elevation is 3820 m (CAI World Factbook 2006), the highest in the country.

Chirripo means "Land of the Eternal Waters", and a lot of streams and lakes are seen, especially in the rainy season. Many plant species are endemic to this area (Pucci 2001).

Costa Rica has two seasons: the dry season and the wet season. The mountain ranges contribute to the variation of the climates. Especially in the west side of the Talamanca Mountain Range, the difference of two seasons is obvious. The dry season is from December to April. Trade winds come from the east side, and moist air is dumped off on the Caribbean side of the mountain ranges. Therefore, the Pacific side is drier while the Caribbean side is kept relatively wet. The rainy season, also called the green season, is from May to November. Since the trade winds move to the north of Costa Rica, moist air rises from both the Pacific side and the Caribbean side of the country (Trejos 1996).

People and Life

In Costa Rica, people live in peace and love. One of the biggest reasons that I liked Costa Rica is that the community is very family-oriented and everyone is easy going. Music is central in their life. They sing and dance everyday, everywhere. The national sport is soccer, and everybody enjoys playing and watching soccer. The phrase "Pura vida", which means pure life, is used everywhere for greetings. Although there are a lot of social problems such as poverty, the goal is the society that allows everyone to enjoy life, regardless of race or gender. Therefore, they accept a lot of immigrants. Traditionally people

in Costa Rica have called themselves "Ticos" as a name of unity (Biesanz 1944).

Their official language is Spanish. Many people speak English as well, which is needed for the ecotourism. Catholicism is the major religion. Costa Rican food is similar to other Central American cuisine. Black beans with rice, called gallo pinto, is a staple food. Coffees and tropical fruit juices are common beverages.

Although the number of indigenous people is only one percent of the total Costa Rican population, there are a lot of reservations. Most of them are located in the Talamanca highland, in the south of Costa Rica, near the border of Panama. Cabecar, Bribris, Naso Teribe and Ngobes inhabit the Talamanca highland (Trejos 1996). The indigenous group close to Cerro de la Muerte is in San Gerardo de Dota and relatively young. The first settlers arrived and colonized the area only some 50 years ago (Van Omme 1997).

History, Politics and Economics

During the pre-Columbian period (before the 16th century) indigenous people lived by hunting and fishing with some

supplement of a few basic crops. Research has shown that people have lived on the edge of the Cordillera de Talamanca in Costa Rica and Panama since around 2000 BP (Watson et al 1998). For example, the pollen and charcoal evidence shows that the small basin of Laguna Zoncho had been occupied and maize had been grown (Clement and Horn 2001).

Costa Rica was discovered by Christopher Columbus on his last voyage to the new world in 1502. Inspired by the spectacular beauty of the land they discovered, they named it "Costa Rica" meaning rich coast. Over time, the Spanish married natives and a large mestizo class was created (Trejos 1996). Initially the colonial period was characterized by a communal or small land parcel system. In the early 1800s, the coffee plantation was developed, which produced a division of social classes. Banana plantations were developed in the Atlantic regions, which tended to degrade the land. Banana plantations were capital- and labor-intensive, especially during planting and harvesting, and this caused many settlements to form communities close to the virgin forest (Watson et al 1998).

On 15th September 1821, Costa Rica became independent from Spain. Social development of the country is especially influenced by declaration of free, compulsory education (1869), which helped

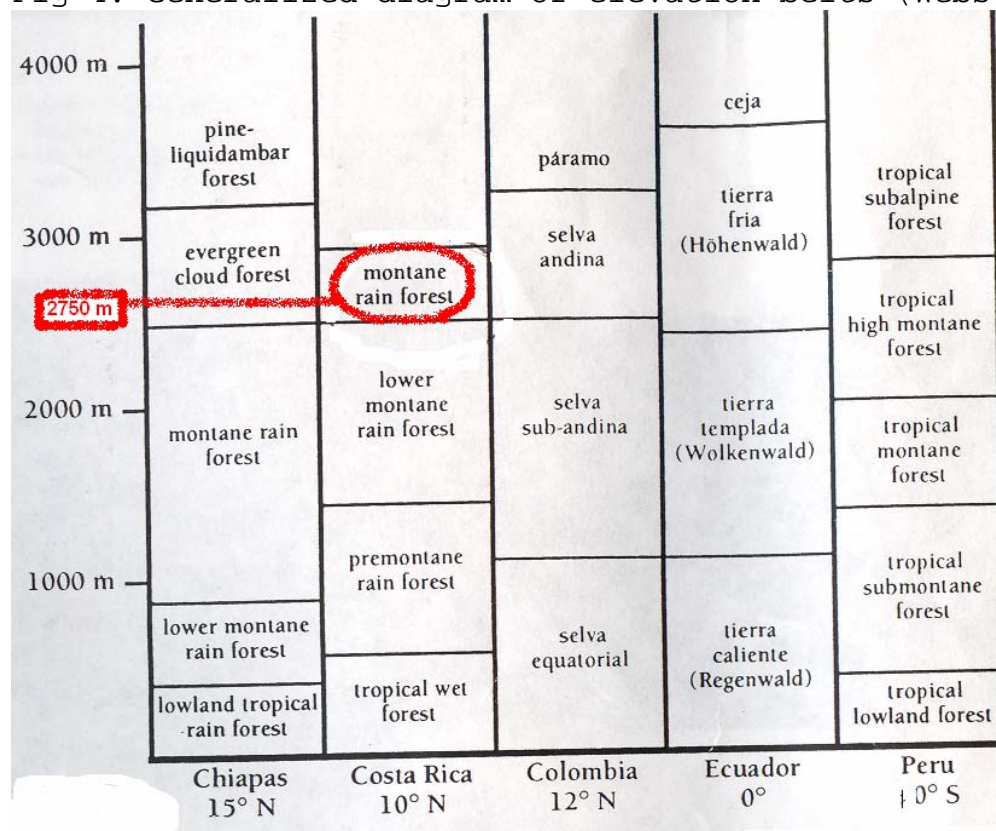
to shape the development of a more democratic political process in the twentieth century (Watson et al 1998). Having experienced reformism from the end of 19th century to 20th century, Costa Rica had a big change. In 1948, the government abolished the army. In 1987 President Oscar Arias received the Nobel Peace Prize, for his work for lasting peace in Central America that resulted in the end of the Civil War in neighboring Nicaragua (Trejos 1996).

Since 1990, sustainable development has been focused, and ecotourism has developed. Ecotourism is one of the important sources of economic income followed by agricultural crops such as coffee, banana and pineapple, and electric export (CIA World Factbook 2006). Costa Rica is relatively stable in Central America in terms of economy and politics.

Characteristics of Cloud Forests

The cloud forest is one kind of rain forest, mostly covered with clouds as its name implies. More precisely, the cloud forest is characterized by perhumid atmosphere, prevalence of bryophytes and vascular epiphytes, reduced stature of trees, and floristic composition deviating from that of low land (Schimper 1903) (picture 4). Cerro de la Muerte is called cloud forest. The lodge that I stayed was located at 2750 m elevation. It is categorized as the montane rain forest in a narrower term (Fig 4).

Fig 4. Generalized diagram of elevation belts (Webster 1995)



Neotropical cloud forests extend from 23N° to 25°S. A typical (modal) cloud forest is generally found between 1000 and 3000m. Total precipitation is generally between 2000 and 4000 mm per year. Mean annual temperature decreases with elevation in a gradient from 18 to 22°C at 1000m elevation to less than 10°C at 3000 m. (Webster 1995)

Cerro de la Muerte means "mountain of death" in Spanish. According to the local people, that is because it is relatively low in temperature and becomes dark due to the fog cover. People thought they would die if they lived there.

Because of the moisture cover at high elevations, the temperature is relatively low. I stayed there from April to June. Until the end of April, it was the dry season and after that it became the rainy season. The mean annual temperature in this area is approximately 9°C on mountain peaks (3200-3491 m) and about 16°C in the valley bottom at 2000 m. January is the coldest month (Kappelle and Zamora 1995). During my stay in the mountains, 0 °C at night was the minimum temperature while 17 °C during day was the maximum. There is a big temperature difference between day and night. Overall, the dry season is relatively colder than the rainy season.

The cloud forest is famous for its biodiversity. The first question is how biodiversity is defined. According to World Resource Institute (1992), biodiversity is defined as "the totality of genes, species, and ecosystems in a region". Genetic diversity is the variation of genes within species. Species diversity is the variety of species within a region, which is often referred to as taxonomic diversity. Ecosystem diversity is the "boundaries" of communities. Biodiversity is important because all living things including humans depend on their relationship with other species in the ecosystem.

Mesoamerica overall is recognized as one of the largest world "hot spots" for biodiversity (Fig 5). Species have flowed in both directions between North America and South America. Their interaction helped produce Mesoamerica's unique and diverse array of life forms. Endemic species include quetzal, howler monkeys, and 17,000 plant species. The region is also a corridor for many Neotropical migrant bird species (Conservation International 2006).

Fig 5. Diversity and Endemism (Conservation International 2006)

Taxonomic Group	Species	Endemic Species	Percent Endemism
Plants	17,000	2,941	17.3
Mammals	440	66	15.0
Birds	1,113	208	18.7
Reptiles	692	240	34.7
Amphibians	555	358	64.5
Freshwater Fishes	509	340	66.8

Having a variety of geographical features, Costa Rica contributes to the biodiversity of Mesoamerica. While Costa Rica represents only 0.035% of the Earth's territory, scientists presume between 3 and 7% of all species to be living within its boundaries (Fuchs 1997). The Amistad Biosphere Reserve, including most of the Cordillera de Talamanca, has been defined as a World Heritage Site and a Centre of Plant Diversity (Groombridge 1992).

Speciation occurred by long-distance dispersal and geographic isolation (Burger 1995). In the Cordillera de Talamanca, the combination of topographic relief and seasonal trade winds from

the east contribute to speciation. It produces a pronounced moisture gradient and highly diversified vegetation communities or life zones (Holdridge 1967). Also speciation has occurred on a smaller local scale. Speciation across pathogen-determined species boundaries may play a role in enhancing the species richness (Burger 1995).

Cerro de la Muerte is in the Los Santos Forest Reserve, which is covered with dense forest. Species-rich flowering plant families in the Los Santos Forest Reserve include the Araliaceae, Asteraceae, Ericaceae, Lauraceae, Melastomataceae, Myrsinaceae, Panacea, Rubiaceae, and Solanaceae. The montane cloud forest is characterized by oaks 30-40 m tall, festooned with epiphytes (Kappelle 2000). Generally, the cloud forest located at 2600 m above sea level contained forests dominated by *Quercus* in association with *Weinmannia*, among others. *Clusia*, *Nectandra*, and *Schefflera* are tree genera with considerable aerial crown covers in the subcanopy layer. At an elevation of 2900 m, the forest canopy is exclusively dominated by *Quercus*. In the subcanopy layer one frequently comes across *Schefflera* and *Weinmannia*, and the understory is made up of dense clumps of *Chusquea* (Kappelle and Zamora 1995). Since Cerro de la Muerte is located in this range, you can see most of those species (refer to Appendix B).

These various kinds of plants attract birds. There are a lot of hummingbirds and migratory birds in Cerro de la Muerte.

Generally, the birds in the montane oak forest (around 2800 m), includes the collared redstart, the flame-throated warbler, the buffy tufted-check, the band-tailed pigeon, and the mountain robin. The lower montane forest, which is around (around 1500 m), includes the quetzal, the emerald toucan, the black guan, the slate-throated redstart, many ovenbirds and tanagers, the black-faced solitarire, and prong-billed barbet (Stiles and Skutch 1989). In Cerro de la Muerte, I saw most of the birds listed in montane oak forest and some birds listed in lower montane forest. The bird species I have recognized in Cerro de la Muerte are listed (refer to Appendix C).

The Relationship between Quetzal and Aguacatillo

In this section, I would like to focus on two famous species in the cloud forests; Resplendent Quetzal (*Pharomachrus mocinno*) and Aguacatillo (*Persea caerulea*) that I think are key species.

The upperparts, head, neck, and chest of quetzal are brilliant golden green. Underparts posterior to chest are intense carotenoid red. Quetzals have yellow bill, dark brown iris and dull orange-brown feet and toe. The males and females are distinctive because the cheek and laterofrontal feathers of females are much less developed (Johnsgard 2000).

During spring the male engages in occasional fight displays, circling above the forest canopy. The male's breeding territory is roughly spherical and averages 300-350 m in radius, extending up to about 4m above canopy. Vocalizations of quetzal have been recorded. For example, calls of a captive female and male are recorded (Johnsgard 2000). In Costa Rica, the eggs or incubating birds are found during April, May and June. Six nests are described. They range from 4.3-27m above ground, with entrances 10-11.4 cm in diameter. Due to the similarity of the shape, there is a possibility that quetzals take over old wood pecker holes. It is noted that the incubation period was 17-18 days.

Nestling quetzals are hatched with tightly closed eyes (Skutch 1983). The male parent brought more food items to the nest than did the female, and these items included more insects; whereas the female delivered relatively more fruits (Wheelwright 1983).

The distribution of quetzal is from eastern Oaxaca and Chiapas in Mexico to western Honduras, eastern El Salvador (Honduran border region), and north-central Nicaragua; local in the mountains of Costa Rica (Tilaran and Talamanca Mountains and the central cordilleras) and western Panama (Johnsgard 2000).

Generally the quetzal is found the Lower Montane Forest, which is around 1500 m (Stiles and Skutch 1989). However, the quetzal is present wide variety of ranges. The habitat of the quetzal in Costa Rica is described as:

Fairly common resident of forested or partly forested mountains from Cordillera de Tilaran S to Panama; upward from 4000ft (1200m) in Cordillera de Tilaran, and from 5000ft (1500m) to over 10,000ft (3000m) in Cordilleras Central and de Talamanca; following breeding makes limited altitudinal movements; persists in largely deforested area if remnant woods contain good feeding and nesting trees.
(Stiles and Skutch 1989)

According to Skutch (1983), quetzal habitats are cloud forests rich in oak, laurel, mulberry, wild fig, and liquidambar trees and having abundant epiphytic vegetation. The fruits of the Laurel family (Lauraceae), especially wild relatives of the avocado (*Persea* sp.) were found to be an important element of the quetzal's diet.

Lauraceae has evolved from woody magnolia forebears. The avocado (*Persea americana* Mill.) is a polymorphic tree species (Scora and Bergh 1990). Aguacatillo, *Persea caerulea* is thought to be a kind of wild avocado. The height is around 15-20 m, and the size of the fruits is around 3-4 cm in diameter.

Avocado trees are capable of rapid growth in height and spread, with 1m per year not unusual in young trees in the most subtropics (Scora and Bergh 1990). The length of the juvenile phase is quite long, reaching 15 years or more. Avocado seedlings do not flower during their first years. Avocado flowering may start in the autumn and end in late spring. The typical flowering season lasts about two months (Schaffer and Whiley 2002). The avocado flower opens twice and these openings are separated by at least one overnight period. There are two possible routes of pollination in avocado: self-pollination and cross-pollination. The dichogamy of the avocado flower dictates

the need for pollinating agents to transfer pollen to the stigma of the female-stage flowers. Insects are the predominant pollinating agents (Gazit and Degani 2002).

All avocado species originate wholly (West Indian, Guatemalan) or partly (Mexican) within tropical latitudes in Central America, and the tree is often popularly referred to as a 'tropical' species. Climate in the areas of origin has a mean annual temperature of 15.9°C, and rainfall of 860 mm with a pronounced summer/autumn peak and a 6-8 month winter/spring dry period (Praloran 1970). Although they can grow in a wide ecological range, they prefer relatively high elevations, low temperatures, and a lot of moisture.

Research shows that in the Monteverde area, the cloud forest located north from San Jose, of 41 plant species (17 plant families), nearly half (17-19 species) are in the Lauraceae. Since it has been shown that quetzal undergoes altitudinal, seasonal migration (Wheelwright 1983, Powell and Bjork 1995), it has been predicted that the abundance of Lauraceae fruits are particularly important in determining the quetzal's migratory behavior (Wheelwright 1986).

On the other hand, another paper on the cloud forests in

Southern Mexico shows that quetzal abundance at the study site was not significantly correlated with the total availability of fruits in the Lauraceae; instead, it was associated with the total number of fruiting species in the forest during the different seasons of the year (Solarzano et al 2000). The proportion of species of fruits consumed belonging to the family Lauraceae was 41% (Wheelwright 1983) and 40% (Solarzano et al 2000). The nestling's diet also shows same result except they eat more insects than fruits. The proportion of species of fruits consumed belonging to the family Lauraceae was 33% (Wheelwright 1983) and 37.5% (Solarzano et al 2000). The similarity of this proportion suggests that not only fruiting Lauraceae species but also availability of other fruiting species determines the quetzal's migratory behavior.

Since the quetzal is a migratory bird, a small area of fruiting species abundance is still not enough for the quetzal habitats. It is required for the quetzal to have a large area of fruiting species abundance. Generally, in the process of reservation design for migratory species, it is important to study ecological linkage (Wheelwright 1983).

A study on quetzal in Monteverde National Park was conducted to find out the pattern of migration of quetzal. Monteverde

National Park is the reservation of cloud forest located to the north from San Jose. In 1989, the reserve complex was largely extended onto both the Pacific and Atlantic slope, but the study indicates that the reserve failed to provide adequate habitat protection for the quetzal. Expanding the protected area has been suggested because of the complexity and unequivocal migration makes it hard to generalize the reservation design pattern (Powell and Bjork 1995). As a result, in most of the quetzal's range, habitat fragmentation has been extensive during recent decades. Therefore, quetzal populations are declining and their degree of isolation is increasing rapidly (Powell and Bjork 1994).

Now, the quetzal is classified as endangered on the U.S Endangered Species Act. An endangered species is the one that is in danger of extinction throughout all or a significant part of its range. A threatened species is the one that is likely to become endangered in the foreseeable future (Nagal 1999). Also, in "the ICUN Red List of Threatened Species", Quetzal is classified as "Threatened", "Lower Risk/near threatened" (World Resources Institute 1992).

I could see quetzal by the lodge located in Cerro de la Muerte in the Cordillera de Talamanca, about 2750 m above sea level. In

the territory of ecolodge Iyök Ami, Aguacatillo (*Persea caerulea*) is one of the most famous trees of the Lauraceae attracting quetzal. In Cerro de la Muerte, there are various species of Lauraceae. At the same time, other plant species are abundant throughout the area. There is a possibility that a lot of quetzal habitats the area are due to abundance of species whose fruits might be available for quetzal throughout the year.

However, it should be noted that the number of quetzal could be decreasing in part of the Cordillera de Talamanca where deforestation is occurred. If the number of observed quetzal is decreasing, the number of plant species could decrease because quetzal is a specialized frugivore which may play an important role as a seed dispersal agent in its habitat, particularly after the nesting season, when it occupies a home range of 6 to 10 ha (Labastille and Allen 1969) .

In order to protect the quetzal, it is important to observe the pattern of the quetzal migration and recognize all the significant habitats are abundant with the Lauraceae. Eventually, protecting quetzal promotes maintaining the biodiversity in the area.

The Cultural Value of the Cloud Forest

One of the biggest keys for protecting the habitats of quetzal is how local people participate in protecting the land. The discussion here is on how people are tied to the cloud forest. The previous section showed that quetzal and aguacatillo are two of the key species in Cerro de la Muerte in terms of biological value. I would like to focus on how indigenous people consider quetzal and aguacatillo.

Quetzal is historically very important. There is a literature describing Quetzal as a sacred bird of Aztecs.

In the province of Vera Paz they punish with death him who killed the bird with the rich plumes because it is not found in other places, and these feathers were things of great value because they used them as money (Maslow 1986).

Quetzal is a national bird of Guatemala. It is on the money of Guatemala.

Although there is no old literature describing quetzal in Cordillera de Talamanca including *Cerro de la Muerte*, people look them as sacred birds. One man I worked with told me that people have been attracted by the beautiful green color of quetzal and its long wings. Since quetzals never form a big

group like other birds do, they have been looked as the messenger of the god. Therefore, local people would never clear out the cloud forests. Similarly, Wallace (1992), who traveled in Costa Rica, mentioned that local people had special affection for the quetzal, and they wanted to protect the habitats of quetzal.

On the other hand, the fruits of aguacatillo are used for ornament. Medically the leaves are used for bruises, muscular aches, pain. Although aguacatillo is so small that it could not be food for humans, a wild variety of the native avocado species *Persea rigens* (Lauraceae) still grows under natural conditions but it is also cultivated. The in situ conservation of variable populations of this tree species in the Cordillera de Talamanca, one of its centers of origin, is of prime importance, as the species constitutes the genetic resource base for the global avocado market (Kappelle 2000).

Other plants in the cloud forest are important. The use of plants for food and medicine is common. During the five days of break, I had an opportunity to visit Valle de Talamanca located in the east edge of the Cordillera de Talamanca (pictures 10~18). This area is lowland, and forest cover is not as dense as Cerro de la Muerte (picture 10). Although I saw a few cacao

plantations (picture 11), the land is mainly used for banana plantations (picture 13 and picture 14). There are a lot of reservations of indigenous people (picture 15 and picture 16). Indigenous tribes (Bribri and Cabecar) have acquired a high level of ethnobotanical knowledge. I stayed in the small town, called Shiroles where the Bribri tribe lives. I visited their house (picture 17), school (picture 18) and banana plantation. I learned the traditional use of plants. Traditional uses of plants are listed in Appendix D.

The clouds forest in Cerro de la Muerte, where I mostly stayed, is so dense that there have not been big communities of people. The indigenous group in the campesino community close to Cerro de la Muerte is relatively young. The first settlers arrived and colonized the area only some 50 years ago (Van Omme 1997). However, the use of plants is more or less inherited from the Bribri tribe. The research on indigenous people of the campesino community close to Cerro de la Muerte shows that the plant families that had the greatest number of species classified as useful plants were Poaceae (13 species), Asteraceae (12), Rosaceae (9), Lauraceae (8), Solanaceae (8), Apiaceae (6), Cucurbitaceae (6), Verbenaceae (6), Brassicaceae (5) and Fabaceae (5) (Kappelle 2000). The uses include (1) combustible (fuelwood, charcoal, matches), (2) construction (fence, fiber,

handicraft, paper, rope, amber, work tool), (3) dye (color), (4) fodder (forage for cattle), (5) gum, (6) medicinal (remedies, drugs, stimulants), (7) nutritional (food, beverage, food colorant, aromatic flavoring, antioxidant), (8) oil, (9) ornamental / ecotourism-related/ scenic beauty (eg, attractive for birds), and (10) poisonous (against rodents). Local knowledge of useful native plants, especially medicinal plants, may therefore disappear in the short or medium term, as San Gerardo is rapidly changing from a rural community dependent on agricultural subsistence into a booming center for fruticultural export, trout production, and ecotourist activities (Kappelle 2000)

The Economic Value of the Cloud Forest

In Cerro de la Muerte, there is not a big community of indigenous people. However, by valuing culture that appreciates the diversity of cloud forest, ecotourism has developed. A lot of people in this area make a living by ecotourism.

Ecotourism is defined as

environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features—both past and present) that promotes conservation, has low visitor impact, and provides for beneficially active socio-economic involvement of local populations (Ceballos-Lascuain, 1996).

I worked one of the ecolodges called Iyök Ami in the Cerro de la Muerte. In this section, I focus on how they developed ecotourism, and why quetzal and aguacatillo are important for ecotourism. Also I analyze some important elements that the ecolodge needs to have.

The objectives and activity of the ecolodge that I stayed include:

- To promote investigation and public education about our ecosystem
- To promote eco-tourism
- To provide care for the environment
- To protect the soil from erosion
- To educate people of the necessity of the preservation
- To stimulate animal and plant populations
- To provide opportunities to live in the jungle in a pure and natural setting
- To promote and maintain water quantity and quality
- To maintain oxygen levels
- To provide facilities for students

They offer an opportunity for students to work and learn about the cloud forest.

Student jobs include:

- Reforestation
- Development and maintenance of trails
- Labeling and transplanting flowering plants near trails
- Drawing topographical or pictorial maps of the area
- Constructing signposts
- Teaching English and ecological programs in the local schools (optional)
- Protecting and stimulating the quetzal bird population

- Classification of plants, birds and fungi
- Maintaining organic gardens
- Examining the diets of the tapir and other native animals
- Maintaining sugar water bottles for hummingbirds
- Preparing handicrafts by using forest materials (optional)

The manager, Mauren Vargas, opened the ecolodge "Iyök Ami", meaning mother earth in Bribri language, in the 1980s. She loves nature and the cloud forest. While deforestation has increased especially in west edge of the Cordillera de Talamanca, she has been interested in conserving beautiful nature. Then she decided to open an ecolodge with one tiny room. She thought education was important in order to achieve cloud forest conservation. Although she knew about the area, she kept studying the ecosystem and biodiversity of cloud forest so she could teach about them to visitors while doing ecotours. She used Bribri language for the name of the lodge because she put value on indigenous people and their culture, which appreciate the nature to conserve the environment. Obtaining knowledge of ethnobotany from indigenous people, she utilized the environment as they have done. She has talked about the story of quetzal and aguacatillo to the tourists. She has maintained an organic garden and green house. She bought a lot of books and made a small library area so tourists could refer to them.

The program for student is very educational. While working, I learned about the cloud forest and culture in Cerro de la Muerte that appreciates nature:

1) Cleaning the trails and giving a tour

Mostly I worked with a local man, Alberto (picture 5). Telling about the old story of quetzal, he sometimes whistled and called quetzal. He taught me the species of plants and their traditional use while working. He was my private Spanish teacher as well. We cut a minimum amount of trees for trails. Before or after hard work, he showed me beautiful nature and told me the natural history. If tourists needed ecotour guide, one local guy gave a tour for them. I walked with the guide. I explained about what I learned during working in the forests as well.

2) Maintaining organic gardens and green house (picture 6)

Lower temperature and moisture is proper for the potato. Some spice and medical plants are planted as well. They don't use pesticides and herbicides. Weeds should be removed frequently otherwise it grows fast due to soil with organic materials and a lot of moisture. In order to protect plants from animals, a green house was constructed. It also protects plants which are susceptible to low temperatures during the night.

3) Identifying plant species and making some signs of plants for eco-tour

I made general signposts (picture 7) such as the advertisement of ecolodge, viewpoints and arrow. They taught me the name of the species in the area. I learned their features and a dichotomous key to identify the plants. I saw a lot of huge tropical plants that I have never seen (picture 8).

During my stay, four students worked in the ecolodge. Their home countries were England, Switzerland and Japan. Generally more people are from the United States. Working in their own field of study, we learned new things and shared the stories of what we learned during the day. We have worked here and been educated. One Costa Rican man, Bedrich stayed in the lodge with us. So to speak, he is a leader of the team. His job includes plan making, entertaining. He made a ping pong table by utilizing the dining table (picture 9).

Osland and Mackov (2004) conducted the comparison study of ecolodges of Costa Rica and Mexico. In this study, ecolodges are classified into four types: casual, dedicated, scientific, and agri-ecolodges. The ecolodge Iyök Ami is categorized in casual ecolodge, which is defined as being located in well-serviced,

accessible area, with the majority of tourists engaged in general nature observation and relaxation. However, it is also scientific since it is used for scientific research, and is an agri-ecolodge since an organic garden is maintained. As a result, various people such as birdwatchers, general tourists, and students visit the ecolodge with different purposes. By containing a lot of elements, a lot of people tend to visit the lodge.

In addition, for the ecolodges in Cerro de la Muerte, quetzal and aguacatillo are important because they attract people. One of the biggest purposes of people who come to the lodge is to see the quetzal attracted by the fruits of the aguacatillo. The manager of the ecolodge obtains financial benefits from visitors by offering rooms and food. Therefore, having targeted species is a big advantage for ecotourism.

Although income generation by ecotourism is significant for the owner of ecolodge, it is not sufficient to encourage conservation and other factors, such as age, education, well-being, religion, and cultural norms, influence behavior (Stem at al 2003). For Mauren Vargas, the mission of teaching the value of cloud forests to visitors and protecting the biodiversity fulfill her life. Learning a lot of new things, visitors are

satisfied. She is happy to see the visitors satisfied with their stay in the ecolodge.

In order to satisfy visitors educational elements are important. During my stay in Cerro de la Muerte, I was surprised that local people are aware of the importance of the cloud forest conservation. I was impressed, and I learned how important the cloud forest conservation is. Wallace (1992) mentions throughout his book that local men knew more about the importance of conservation than he had expected. Jose Maria Rodriguez, a local man, connected the cultural value with the conservation of cloud forest. He said the concept of the keystone species such as quetzal could be useful in determining how much to protect. Wallace was impressed by the local people and their ideas (Wallace 1992).

However, in Costa Rica as a whole, immigrants from foreign country played a role in the area of ecotourism. The study done by Osland and Mackov (2004) shows that 80% of the Mexican ecolodges expressed community-oriented performance goals, whereas only 45% of the Costa Rican lodges mentioned community goals. He determines that is because most of the ecolodges in the sample from Costa Rica are owned by foreigners. None of the Costa Rican ecolodges in the sample is located near an

indigenous people group. Therefore, the focus on cultural value, which appreciates cloud forest, is a key to achieve the success ecolodge, which eventually becomes the community benefits.

The Policy of Costa Rican Government Regarding Cloud Forests

The history of the forests and people in Costa Rica are as follows (Appendix D)

-Before 1950: large landowners emerge, civil society forms and the forests slowly decline.

-From 1950 to 1970: national agriculture development, land titling and massive deforestation

-From 1970 to 1990: protected areas, the rise of forest industry and the end of the agricultural frontier

-From 1990: sustainable development's growing pains

The main problem between 1950 and 1970 is that deforestation occurred and the policy had little regard for the forests.

Between 1970 and 1990, protected areas were constructed, but the policy had little regard for the people. Now the goal of Costa Rican government is to make "policy for forest and people" (Watson et al 1998).

Ecotourism was considered in the policy making process in 1990s when it became a source of national revenue. Government policy is to promote Costa Rica's green image. In the political-economic context, ecotourism is regarded as a source of foreign revenue. There are two kinds of actors: tourism entrepreneurs and the tourist market. Tourism entrepreneurs want incentives

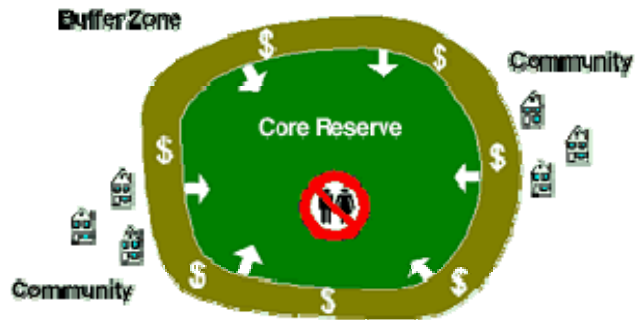
promoting conservation areas. Tourist market demands policies on tourism and biodiversity. The effect on the forest is that forest scenic and biodiversity values are conserved. The effect on people is a strengthened eco-tourism sector, a search for local approaches in regional, community values.

The conflict between forest and people could be explained by the model of three different paradigms. Those paradigms of conservation have been developed in the last century (Fig 6).

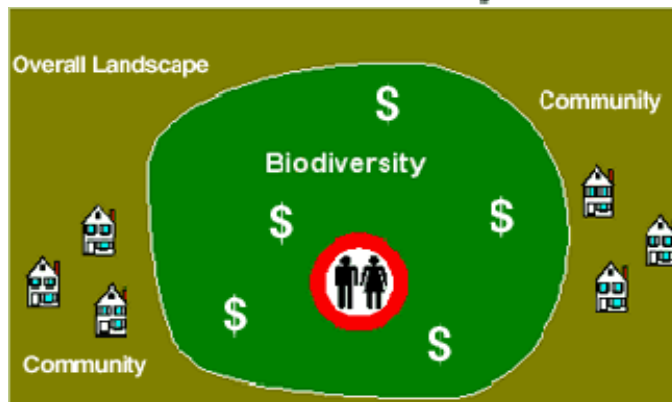
Fig 6. Paradigms of Conservation (Salafsky et al 1999)



PARADIGM 2: Integrated Conservation and Development Projects (ICDPs)



PARADIGM 3: Directly Linking Conservation and Community Benefits



The first one is "parks and protected area". The strategy is surrounding the protected area with fences. However, this did not work in the developing world because the economic status of people living around the park is low due to prohibition of natural resource use.

The second one is "Integrated Conservation and Development

Project (ICDP)" The buffer zones are provided for the economic well-being of the residents surrounding the reserve. It creates "indirect link" between the habitats and the surrounding human populations. The problem is that the local people may hunt or expand their farms (internal threat), and a large logging company may come in to clear-cut the forest from the other side of the reserve (external threat).

The last one is "Directly Linking Conservation and Community Benefits". The goal here is to try to develop direct links between the biodiversity and the surrounding human populations. If humans can directly benefit from the biodiversity, they will identify and take action against both internal and external threats to the biodiversity. The third paradigm has been tested and has not been evaluated.

My understanding is that Cerro de la Muerte is somewhat categorized between paradigm two and three. It is located in the area called Los Santos Forest Reserve. However, there is no separation between private land community and buffer zone.

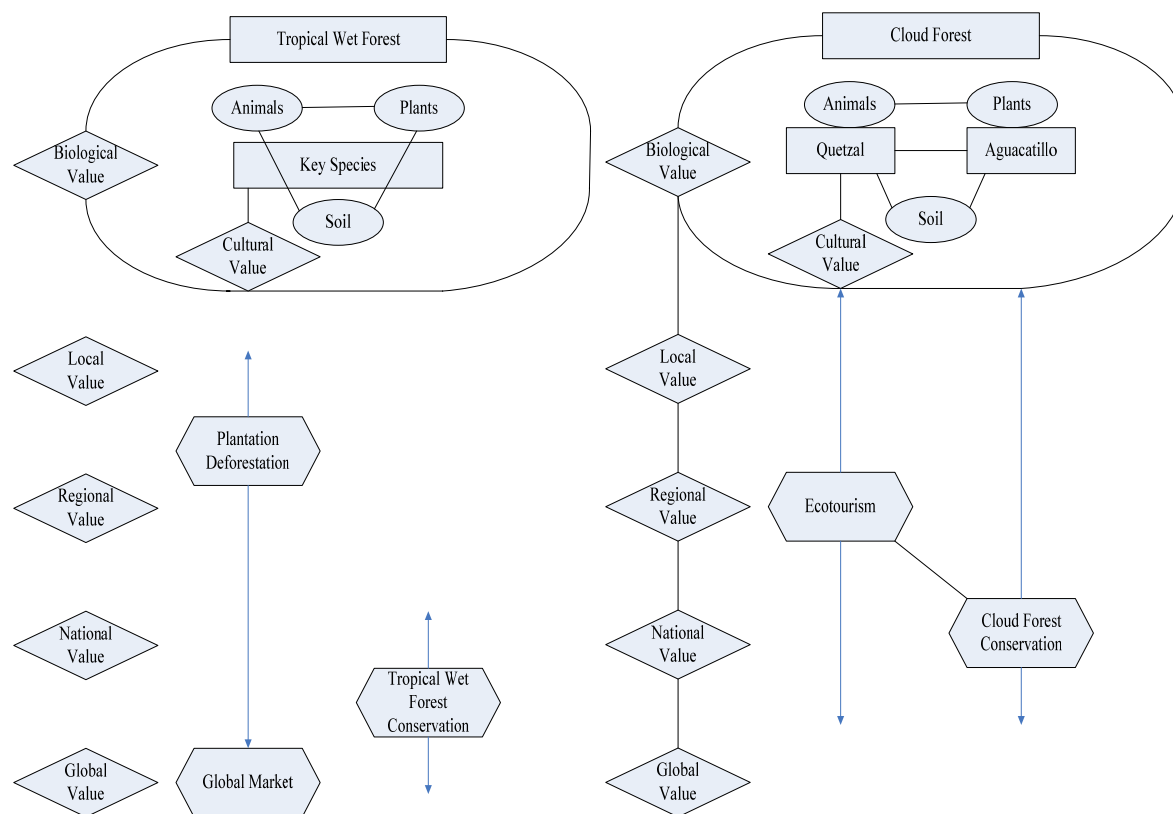
Summary and Discussion

Costa Rica is one of the most biologically diverse countries in the world. It is known as a country that is advanced in terms of environmental conservation. However, it used to be one of the countries that had a high deforestation rate until 1970. From 1970 to 1990, the policy failed because it did not work for people. Natural resource utilization is a social process in which different interest groups, with diverse and often conflicting intentions, confront each other at local, regional, national and global levels (Schmink and Wood 1992). Realizing the importance of local people, since the 1990s Costa Rica actually has a policy goal that works for forests and people. The government is trying to find the point where both of them are balanced, which is what is truly meant by "a policy that works for the forest and the people"

In reality, it is hard to achieve the goal because economy of local people is in conflict with global conservation. I saw one of the communities in Shiroles, the east edge of the Cordillera de Talamanca, where people use lands for plantations. For economic revenue, people need plantations. However, I saw a lot of disturbed area. It becomes a conflict between local development and environmental conservation (left side of Fig 7).

On the other hand, according to the definition of ecotourism, in an ideal condition, successful ecotourism could achieve conservation of biodiversity of cloud forest and provision of economic benefit to local people at the same time (right side of Fig 7) (Ceballos-Lascuain 1996).

Fig 7. The Model of Natural Resource Utilization



There are many sites and strategies for ecotourism. The area protected as national park attracts people and contributes to the economic revenue of Costa Rica. However, local people are not able to be a part of ecotourism. People who live near the

protected area were susceptible because they have neither enough land to use nor financial support from the government. That has been pointed out as problems in many areas. The creation of a great number of protected areas has also significantly affected many rural communities, some of whom have been displaced without adequate compensation, or whose lands have been bought out at much less than the market value (Watson et al 1998).

Cerro de la Muerte is relatively protected without a strong separation of protected area and private area but more like private land is located in the reserve. As "Directly Linking Conservation and Community Benefits", the goal is to try to develop direct links between the biodiversity and the surrounding human populations. In this case, the conservation of the forest is directly affected by local people. It depends on local people if the forest conservation is successful.

I worked in one private ecolodge Iyök Ami in the cloud forest with a hope of understanding how they value the cloud forest. I analyzed how local people are connected to cloud forest and what are the important elements for ecotourism. As definition of ecotourism indicates, cultural value has played an important role. In Cerro de la Muerte, the beautiful bird quetzal is relatively abundant. Both quetzal and aguacatillo are culturally

meaningful. Mauren Vargas, the owner of the ecolodge, focuses on the cultural value and got knowledge about medicinal plants and spices from indigenous people. Many visitors came to the ecolodge in order to see quetzal on the aguacatillo. Therefore, quetzal and aguacatillo is significant for ecotourism. Also she constructed organic garden and green houses for the staples. As a result, she could successfully teach the values of the cloud forest and its biodiversity.

In biological term, quetzal and aguacatillo are important for maintaining biodiversity. The abundance of Lauraceae fruits is important as well as the abundance of other fruiting species for food source of quetzal. Since the quetzal is a migratory bird, it is important to have large area of fruiting species abundance. By trying to protect these plant species, eventually biodiversity is maintained.

In this study, I investigated how the cloud forest, the quetzal and aguacatillo, and community benefit from ecotourism are inter-related. Especially I focused on the perspectives of local people. It is shown that the quetzal and the aguacatillo are key species because they contribute to both cloud forest conservation and community benefits from ecotourism. The recommendation for the ecolodge is to target variety of people

and to make the best use of the key species. One of the biggest roles for ecolodge is to educate visitors. The owner could focus on the cultural value which appreciates the nature. This case study also suggests that it is important for policy maker to recognize how local people affect nature and to find and research the keys species.

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Appendix A: Pictures

Cerro de la Muerte

Picture 1: Montaneous rainforest, the view from the ecolodge on sunny day

Picture 2: Quetzal on the aguacatillo in front of the ecolodge

Picture 3: Aguacatillo and signposts with its name and some explanation

Picture 4: Bromeriad, common epiphytic plants in the cloud forests

Picture 5: A forest man who cleans up trails, also an important educator

Picture 6: Greenhouse which protect animal

Picture 7: Making signposts

Picture 8: A number of huge tropical plants I have never seen

Picture 9: Local guy making ping-pong table, which plays an important role to be friends with ecotourists

Shiroles ~ the Village of Indigenous People~

Picture 10: Lowland tropical wet rainforest where indigenous people live

Picture 11: Cacao tree growing under banana tree

Picture 12: Indigenous people; elementally school student

Picture 13: Banana plantation and wild pig

Picture 14: Transporting banana by track and boat

Picture 15: Indigenous people; a mother and children going home

Picture 16: Indigenous people; a man studying English

Picture 17: Elementary school, utilizing banana leaves, open classroom

Picture 18: A house, utilizing banana leaves

The highest part of the Cordillera de Talamanca

Picture 19: Cerro Chirripo with the elevation 3820 m.

Resplendent Quetzal (Pharomachrus mocinno)

Picture 20: a big picture of quetzal, the key species in the cloud forest

Cerro de la Muerte



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Shiroles ~ the Village of Indigenous People~



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12.



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18.

The highest part of the Cordillera de Talamanca



19.

Resprensent Quetzal (Pharomachrus mocinno)



20.

(source: Costa Rica Exotica Natural)

Appendix B: Plant Species that I saw ecolodge territory in Cerro de la Muerte

Genus and species	Family	Common name (Spanish)
<i>Persea caerulea</i>	Lauraceae	wild avocado (aguacatillo)
<i>Podocarpus costaricensis</i>	Podocarpaceae	(ciprecillo)
<i>Rhamnus spp</i>	Rhamnaceae	
<i>Myrsine costaricensis</i>	Myrsinaceae	(ratoncillo)
<i>Drimys granadensis</i>	Winteraceae	(chilemuelo)
<i>Blechnum sp.</i>	Blechnaceae	
<i>Diplazium sp.</i>	Woodsiaceae	
<i>Polypodium museum</i>	Polypodiaceae	fern (helecho)
<i>Weinmannia spp.</i>	Cunoniaceae	
<i>Fuchsia spp.</i>	Ongraceae	
<i>Elaphoglossum sp.</i>	Elaphoglossaceae	
<i>Moconia spp.</i>	Melastomataceae	
<i>Quercus costaricensis</i>	Fagaceae	oak (roble)
<i>Justicia tinctoria,</i>	Acanthaceae	indigo (azul de mata)
<i>Aloe vera</i>	Liliaceae	aloe vera (sabila)
<i>Buddleja americana</i>	Loganiaceae	American butterfly bush (salvia virgen)
<i>Alfaroa costaricensis</i>	Juglandaceae	
<i>Annona muricata</i>	Annonaceae	
<i>Quercus insignis</i>	Fagaceae	oak (roble)
<i>Alfaroa costaricensis</i>	Juglandaceae	
<i>Guatteria talamancana</i>	Annonaceae	(anonillo)
<i>Clethra maxicana</i>	Clethraceae	
<i>Billia colombiana</i>	Hippocastanaceae	(cucaracho)
<i>Croton draco</i>	Euphorbiaceae	(sangre de draco, sangrillo)
<i>Anthurium</i>	Araceae	
<i>Crocasmia crocosmiiflora</i>	Iridaceae	
<i>Asplenium spp.</i>	Aspleniaceae	
<i>Blechnum spp.</i>	Blechnaceae	
<i>Elaphoglossum herrerae</i>	Elaphoglossaceae	
<i>Dendropanax arboreus</i>	Araliaceae	
<i>Weinmannia pinnata</i>	Cunoniaceae	
<i>Huperzia spp.</i>	Lycopodiaceae	
<i>Nertera granadensis</i>	Rubiaceae	
<i>Ocotea spp.</i>	Lauraceae	
<i>Nectandra sp.</i>	Lauraceae	
<i>Beilschmiedia spp.</i>	Lauraceae	
<i>Werauhia spp.</i>	Bromeliaceae	

Appendix C: Bird Species that I could identify in the ecolodge territory in Cerro de la Muerte

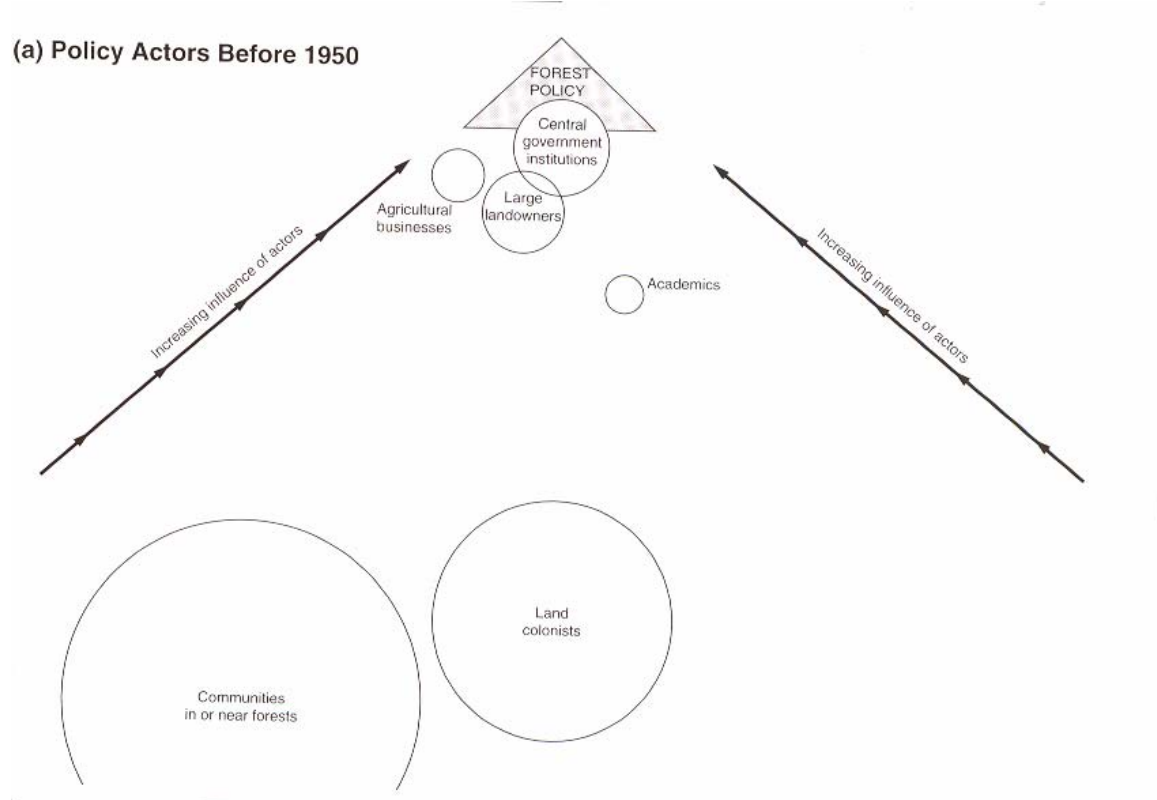
Genus and species	Common name
<i>Pharomachrus mocinno</i>	Resplendent Quetzal
<i>Trogon aurantiiventris</i>	Orange-billed Trogon
<i>Panterpe insignis</i>	Fiery-throated Hummingbird
<i>Eupherusa eximia</i>	Stripe-tailed Hummingbird
<i>Elanoides forficatus</i>	Swallow-tailed Kite
<i>Streptoprocne zonaris</i>	White-collared Swift
<i>Elvira cupreiceps</i>	Coppery-headed Emerald
<i>Parula gutturalis</i>	Flame-throated Warbler
<i>Euphonia elegantissima</i>	Elegant Euphonia
<i>Buarremon brunneinucha</i>	Chestnut-capped Brush-Finch
<i>Empidonax flavescens</i>	Yellowish Flycatcher
<i>Mitrephanes phaeocercus</i>	Tufted Flycatcher

Appendix D: Traditional Uses of Plants

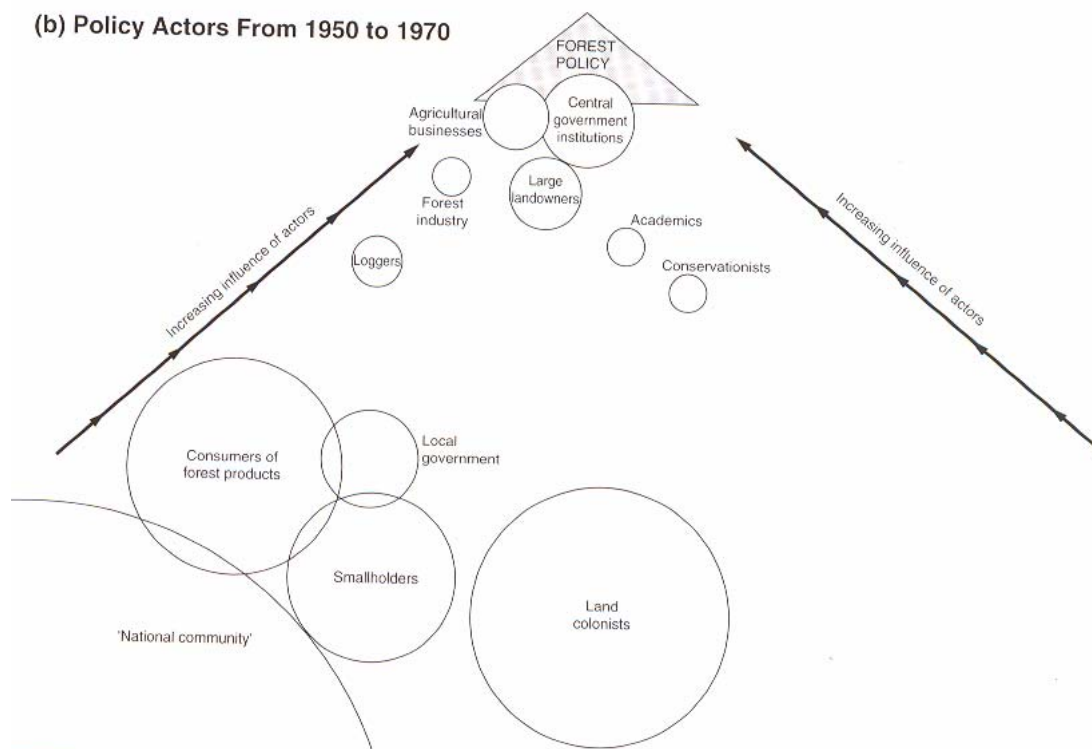
Genus and species	Family	Common name (Spanish)	The use
<i>Justicia tinctoria</i>	Acanthaceae	Indigo (azul de mata)	for stomach for dye
<i>Aloe vera</i>	Liliaceae	Aloe Vera (sabila)	for skin for pain
<i>Theobroma cacao</i>	Sterculiaceae	Cacao (crillo)	for fever
<i>Quassia amara</i>	Simaroubaceae	Cuasía	for stomach for snake bite
<i>Equisetum bogotense</i>	Equisetaceae	Horsetail (cola de caballo)	for sleep
<i>Zingiber officinale</i>	Zingiberaceae	Ginger (jengibre)	for seasoning
<i>Neurolaena lobata</i>	Astraceae	Jackass bitters (gavilana)	for stomach
<i>Lippia graveolens</i>	Verbenaceae	Oregano	for seasoning for asthma
<i>Buddleja americana</i>	Loganiaceae	American butterfly bush (salvia virgen)	for inflammation
<i>Momordica charantia</i>	Cucurbitaceae	Momordica (pepinillo)	for fever

Appendix E: Forest Policy in Costa Rica (Watson et al 1998)

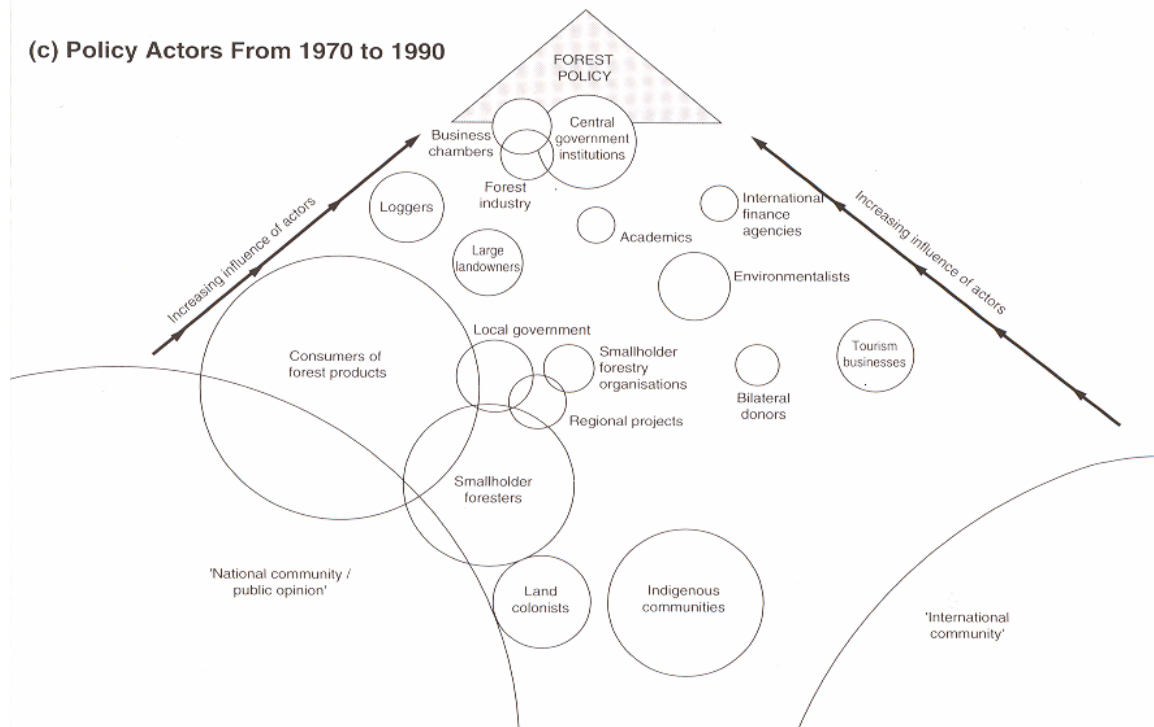
(a) Policy Actors Before 1950



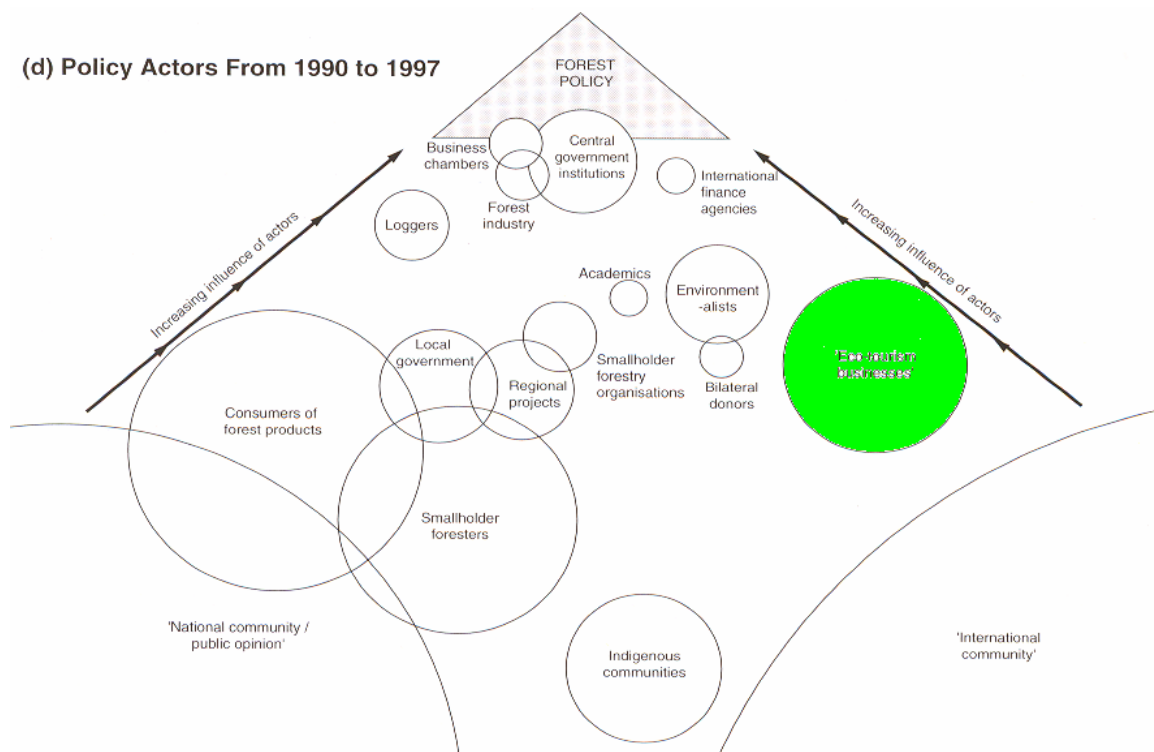
(b) Policy Actors From 1950 to 1970



(c) Policy Actors From 1970 to 1990



(d) Policy Actors From 1990 to 1997



(a) Summary of policy processes influencing forests and people in Costa Rica before 1950 (Watson et al 1998)

Political-Economic Context	Government Policy Instruments	Actors and Actions	Effects on Forest	Effects on People
Communal or small land parcel system breaks down and larger private holdings form	Executive decrees: ban burning, instruct protection and reforestation of watersheds	President and politicians make decisions with modest impact on forests	Forest cover is reduced from 99% of national territory in 1500 to 72% in 1950	Large agro-export-growing landholders have strong hold over economy and politicians
Subsistence production for majority	in Central Valley region	Indigenous peoples displaced by settlers	Some conservation of river banks and watersheds in Central Valley region	Formation of national identity, partly through colonisation of national territory
Increasing monoculture production by large landholders: coffee in Central Valley and banana in Atlantic region	'Family Providers' Law, 1934 requires land to be cleared to prove ownership	Smallholders grow subsistence crops		More equitable access to health care, education and civil rights from 1940s
Initial agro-exports		Agro-exporters control much agricultural land and generate agricultural expansion		Smallholders begin to gain more access to land
Social development prioritised in 1940s		Academics found University of Costa Rica and promote conservationist ideas		Early emergence of conservation consciousness amongst educated elite

(b) Summary of policy processes influencing forests and people in Costa Rica from 1950 to 1970 (Watson et al 1998)

Political-Economic Context	Government Policy Instruments	Actors and Actions	Effects on Forest	Effects on People
National development of infrastructure, state institutions and technology	Clearing of National Reserve land and individual titling by ITCO, under Land Tenure Information Law	Politicians promote cattle ranching as state policy ITCO and MAG regulate agriculture and forestry	Accelerated reduction, fragmentation and deterioration of forest lands. Conversion to pasture - total forest cover is reduced from 72% in 1950 to 56% in 1970.	Concentration of capital in business sector with the rise of export agriculture and timber industry
Import substitution economic model	Subsidised bank credit for agriculture and ranching	Forest entrepreneurs commercialise timber resources		Proletarianisation of the smallholder sector
Population growth				Migration of poorer urban dwellers and landless rural population to 'frontier' areas
International markets favour sugarcane, beef coffee and bananas	The first Forest Law (4465) sanctions clearing of forests for agriculture	Large landowners consolidate their land control		
Commercialisation and industrialisation of timber	Legal protection of watersheds and riverbanks Legal basis for large protected area demarcation Limited timber extraction Banning of uncontrolled fires	Some smallholders proletarianise in response to concentration of capital and land Others become colonists in agricultural 'frontier' forest areas Academics promote conservationist ideas International agencies stress agricultural development		Rise of land titling amongst colonists on the 'frontier'

(c) Summary of policy and processes influencing forests and people in Costa Rica from 1970 to 1990 (Watson et al 1998)

Political-Economic Context	Government Policy Instruments	Actors and Actions	Effects on Forest	Effects on People
Import-substitution economic model in 1970s	Promotion, regulation and technical assistance for commercial uses of forests	Legislators create regulatory base for DGF (forest management) and SPN (protected areas)	Public and private protected areas cover about 29% of the national land by 1990	Society benefits from creation of protected areas
Autonomous central institutions formed, local government weakened	Creation and 'fencing in' of protected areas	Technocrats operationalise forest institutions	Continued colonisation until all national land allocated	Tourism emerges as important source of revenue
Land invasions by smallholders in 1970s	National Plan for Forest Development 1979	Forest entrepreneurs secure incentives for reforestation	Expansion of banana production areas	Communities displaced by protected areas
Structural economic reforms in 1980s	Tax incentives for reforestation in 1980s	Large forestry businesses control industry and form first Chambers of Forestry	Deforestation of 500,880 ha of natural forest; 39% of national territory remaining as forest in 1990	Large forestry businesses benefit from incentives
Land use alternatives to cattle farming in 1980s	Reforestation incentive bonds initiated in late 1980s	Smallholders increase organisational strength and start promotion of reforestation		Smallholders begin to benefit from forestry activity
End of the agricultural frontier	Land Use Capability System - basis for permits and incentives	Academics provide training and carry out research		Strong public awareness of environment
National 'sustainable development' approach in late 1980s	Valuation of biodiversity and founding of INBio 1989	Conservationist individuals and organisations emerge, quickly organise and begin advocacy. Buy-outs begin to form protected areas		
International/ donor interest in environment/ sustainable development	National Conservation Strategy for Sustainable Development 1987-89			
	Forest Action Plan 1988-90	International agencies give cash and promote agriculture, forests and sustainable development		
	Debt-for-nature swaps			

(d) Summary of policy processes influencing forests and people in Costa Rica from 1990-1997 (Watson et al 1998)

Political-Economic Context	Government Policy Instruments	Actors and Actions
Structural adjustment, reduced public spending, privatisation, market liberalisation	Forestry Law 1996: Partial deregulation of industry	Loggers and forest entrepreneurs are financially consolidated
Reforming state structures	Institutional coordination: creation of SINAC, National Forestry Office	Legislators accept some state decentralisation measures
	Decentralisation: creation of Regional Environmental Councils	Forest industry unions form alliances in Central America
Alternative/innovative financing mechanisms	'Socialising' reforestation: incentives for small producers (CAFA, and FDF)	Smallholders see reforestation as an economic alternative
	Forest Management Incentives (CAFMA)	Coordination of reforestation incentives
	CCB conservation incentives	Smallholders organisations strengthen technical capacity
	Marketing carbon offsets	International agencies provide financial backing for 'social' forestry projects
	National Forestry Finance Fund (FONAFIFO)	
	Netherlands-Costa Rica sustainable development agreement (ABDS)	
'Sustainable development' as national development strategy	Constitutional chapter on ecological guarantees	Academic sector disseminates 'sustainable development' approach
	Organic Environment Law 7554	Foreign companies involved in AIJ
	Activities Implemented Jointly (AIJ) for reduction of greenhouse gas emissions	
	Valuation of forest environmental services	
	Draft Biodiversity Bill	
Eco-tourism as a source of foreign revenue	Promotion of Costa Rica's green image	Tourism entrepreneurs (some of them foreign investors) want incentives promoting conservation areas
		Tourist market demands policies on tourism and biodiversity

Effects on Forest	Effects on People
<p>Increase in privately-owned protected forest areas</p> <p>Decrease in national forest cover from 40% to 30%</p> <p>300,000 ha of secondary forest maintained for 10 years</p> <p>Reforestation on farms and land parcels - 72,000 ha planted through reforestation projects</p> <p>Bioprospecting in protected areas</p> <p>Forest scenic and biodiversity values conserved</p>	<p>Growing resentment in some communities at exclusion from protection area</p> <p>Forestry Chambers of Commerce influential in protecting existing industry</p> <p>Greater participation and strengthened organisation of local actors (e.g. ACA, Hojanca)</p> <p>Smallholder forestry organisations strengthened (JUNAFORCA)</p> <p>Environmental groups more coordinated (FECON)</p> <p>Greater public environmental awareness</p> <p>Strengthened eco-tourism sector, search for local approaches in regional, community</p>