Agroforestry and Conservation in Northern Madagascar: Hopes and Hinderances

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Abstract: In this manuscript we pursue the question, under what circumstances is agroforestry a viable component of conservation? We describe tree-planting and conservation efforts in two protected areas in northern Madagascar. Mt.d'Ambre and Ankarana lie close to each other, have been subject to similar historical pressures, and are administered by the same conservation authorities. Yet aspects of local ethnicity, economy, political organization, social organization, and land tenure differ. The areas also differ in forest structure and conservation pressures. We pay particular attention to the agroforestry efforts of the integrated conservation and development (ICDP) phase of conservation. We note issues particular to protected area management and to the dual needs of protecting forest resources while providing for the needs of the people living around the forests. While some potential and identifiable benefits exist, tree-planting has not always aided conservation efforts in northern Madagascar. Problems have occurred when planners have ignored local forest use, recent forest history, and socioeconomic issues (e.g., land tenure, immigration/migration, local traditions, intergroup conflict, subsistence patterns, kinship). This paper highlights factors that have deterred the overall effectiveness of tree-planting efforts in this region and identifies factors that resource managers and conservationists need to address when initiating successful projects. While critical of many aspects of the agroforestry efforts, we argue that agroforestry should not be abandoned as a component of conservation and protected area management. Such efforts may work in this region if planners: 1) encourage local participation in the development, implementation, and maintenance of these projects, working within the context of local political organization; 2) enhance and maintain long-term communication between planners and local people; 3) facilitate communication both within and between villages; 4) assure individuals or households the ultimate rights or responsibilities for land use; 5) establish a fair distribution of project benefits; and 6) separate the roles of extension workers and enforcement agents.

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INTRODUCTION

Since colonial times in Madagascar, the major goal of tree-planting has been to increase forest surface area in degraded areas. During colonial times and at present, woodlots have dominated as the preferred planting strategy. However, in the early to mid-1990s, integrated conservation and development (ICDP) projects advocated tree planting on household lands, either next to houses or in fields and gardens, according to the principles of agroforestry. Agroforestry (i.e., social or communal forestry) is a multiple land use system in which smallscale farmers raise tree crops with agricultural and animal crops (Benneh 1987). Typically resource managers have identified agroforestry as a strategy for restoring degraded areas, increasing people's access to valued forest products, and conserving existing forest resources (Hough 1991, Nair 1990). In targeting small holders, agroforestry has largely replaced industrial plantation-style forestry schemes. This change in approach arose because of agroforestry's potential for sustained improvement in rural living standards (Guggenheim and Spears 1991, Cernea 1991). Agroforestry strategies have recently focused on introducing nutrient-enhancing species that improve soil quality while providing tree products. Although such species have been introduced in some parts of Madagascar, agroforesters in the north have continued to use the traditional woodlot species of eucalyptus and pine, as well as selected fruit trees.

In this paper, we analyze tree-planting efforts in the Mt. d'Ambre and Ankarana regions of northern Madagascar, paying particular attention to the agroforestry efforts of the ICDP approach to conservation. We note issues particular to protected area management and to the dual needs of protecting forest resources while providing for the needs of the people living around the forests. We argue that while some potential and identifiable benefits exist, tree-planting has not always aided conservation efforts in northern Madagascar. Planners have ignored local forest use, recent forest history, and socioeconomic issues (e.g., land tenure, immigration/migration, local traditions, intergroup conflict, subsistence patterns, kinship). As a result, most attempts at forestry and conservation have faced a myriad of problems. This paper highlights factors that have deterred the overall effectiveness of tree-planting efforts in this region. We also identify factors that resource managers and conservationists need to address when initiating successful projects. While critical of many aspects of the agroforestry efforts, we argue that agroforestry should not be abandoned as a component of conservation and protected area management. Instead, a more socially, politically, and historically informed tree-planting program must become part of a successful effort to reduce pressures on existing forests.

THE SETTING: MT. D'AMBRE AND ANKARA

Mt. d'Ambre and Ankarana lie in far northern Madagascar (Figure 1). Many endemic species of birds, reptiles, and mammals, including at least eleven species of lemurs, inhabit this region (e.g., Rand 1935; Petter et al. 1977; Tattersall 1982; Langrand 1990; Raxworthy 1988, 1995; Rakotosamimanana 1995; Freed 1996). Floristically, the forests of Mt. d'Ambre and Ankarana are isolated from Madagascar's eastern rainforest and the Sambirano, or northwestern forest (Ganzhorn et al. 1997). Mt. d'Ambre and Ankarana are close to each other; only twelve kilometers of savannah separate the two. Both forests are accessible from the east by a paved

national road that connects the northern port city of Antsiranana (formerly Diego-Suarez), Ambilobe (a city south of Ankarana), and the rest of Madagascar.

Located on an extinct volcano, Mt. d'Ambre contains 23,000 hectares of continuous humid evergreen forest. Forest exists between 200 and 1,475 meters in elevation. Above 600 meters, the climate is mostly cool and humid; below, the climate is warm and dry, especially in the north and along the forest edge. The forest canopy is generally tall (18-25 meters), closed, and continuous, and contains little undergrowth. Many trees common in humid Malagasy forests comprise the forest canopy (e.g., Canarium madagascariensis, Chrysophyllum ferrugineum, Cryptocarya spp, and Harungana madagascariensis). Areas where the canopy is neither closed nor continuous are: above 1000 meters; subject to disturbance from humans or cyclones; or lie along steep slopes or the forest edge. Disturbed areas contain dense undergrowth. Although researchers usually classify Mt. d'Ambre as humid rainforest, the climate, forest structure, and disturbance vary with each region (Figure 2).

Mt. d'Ambre is readily accessible to Antsiranana (formerly Diego-Suarez), Madagascar's fourth largest city. Well-established roads lead from this city to towns (estimated population 1,000 - 10,000), and paths connect these towns with many smaller agricultural villages (est. population 50 - 1,000 people) that lie along the forest's periphery and rivers. Light and intensive agricultural communities occur along northern, eastern, and southern Mt. d'Ambre. Local people raise a few crops throughout the year, including rice, mangoes, papaya, litchis, bananas, and small vegetables (e.g., greens, carrots, and beans). In western Mt. d'Ambre, people grow rice near rivers, and herd cattle. In the north, people harvest timber and collect charcoal. Tourism has been a source of income for some families in Joffre-ville, Sakaramy, and Anivorano-Nord.

Although Antankarana and Sakalava ethnic groups are common, many groups have migrated here within the last century. Antsiranana and Joffre-ville have long been associated with the French colonial administration. The former is also a vital Indian Ocean port; its population includes people from throughout Madagascar, other Indian Ocean islands, France, Africa, southern Asia, and China. In those regions accessible by roads (eastern and northern Mt. d'Ambre), Freed encountered no town where one ethnic group predominated. Only in less accessible regions of western Mt. d'Ambre, did most identify with one ethnic group, Antankarana. Also, people in every village have kin in most regions of the forest, and in Antsiranana. People have traversed forests for economic and familial reasons during the last sixty years or more. Freed observed an average of four families traveling from western to eastern Mt. d'Ambre each day during 1990 - 1991.

Ankarana is best known for its Massif, a limestone karst formation with "sunken" forests and more than 160 kilometers of cave passageways. Ankarana (including the massif) contains 18,200 hectares of deciduous dry forest (Figure 2). The canopy is rarely continuous, and is usually 15 - 20 meters tall. The forest consists of species that are usually found in dry forests of northern Madagascar. Undergrowth is extremely dense, particularly around the forest edge. Except for the startling limestone outcropping, the terrain is flat and the elevation is approximately 100 meters. The climate is dry and warm, with only a four-month long wet season. Although karst formations render inaccessible portions of forest, local people have traversed Ankarana for many years. People from villages and cities access the forest by local paths and roads.

Villages surround the Massif, and the city of Ambilobe lies fifteen kilometers south. Ambilobe is an especially busy hub that connects the far north with economic activities elsewhere in Madagascar. Most of the people inhabiting villages identify themselves as ethnic Antankarana. This primarily means that they maintain allegiance to a royal indigenous leader who resides in Ambilobe, but whose royal capital village lies in the periphery of Ankarana. The religious and political leader, or Ampanjaka, claims part of the protected forest as sacred ritual grounds (Gezon 1997a). Many immigrants to the region have also adopted Antankarana identity; few people claim other ethnicity. Immigrants have often come from drought in southern Madagascar either to work in the sugar processing industry or to herd cattle. The dominant subsistence activities are herding and rice agriculture. Patrilineal residential groups usually combine their labor relating to these activities. On the southern side of the massif, however, many people engage in cash-cropping sugar cane or in commercial fishing activities (Gezon 1999).

The research sites share much in common. For one, the same administrative office has managed conservation efforts in both areas. They also share some similarities in that the majority of both their populations identify themselves as ethnic Antankarana; their subsistence activities are both focused on rice cultivation and herding; and their language, material culture, and social organization in general are similar.

The sites also differ significantly. The forest ecology and terrain differ markedly. Villages west of the Ankarana Massif also tend to be located further away from the forest than are most villages of Mt. d'Ambre. Many more people also live around Mt. d'Ambre than do around Ankarana. These factors lead to different resource use patterns and needs. Culturally, the two populations differ somewhat, despite their mutual Antankarana affiliation. Those of Mt. d'Ambre, for example, contain more immigrants, are further removed from the cultural influence of the Antankarana royalty, and are more exposed to the urban influences of Antsiranana.

LAND USE IN HISTORICAL PERSPECTIVE

Deforestation

Current agroforestry efforts must be evaluated in the context of histories of both deforestation and tree-planting. Scholars have debated the causes of habitat change that occurred in Madagascar before French political hegemony in the late 1800's. An extinction of Malagasy megafauna species and rapid aridification of Malagasy flora occurred between 1,000 and 2,000 years before present (see, e.g., Burney 1993, 1997; Jungers et al. 1995). Researchers have attributed the ultimate cause of this environmental change to anthropogenic or natural causes (Martin 1966; Dewar 1984; Jungers et al. 1995). Yet Dewar (1997) has shown that strong supporting evidence does not exist for any one of these hypotheses.

What is indisputable is that human-induced habitat degradation in Madagascar has occurred during the past century. The current ambiguity lies in determining who is responsible. During the last two hundred years many have blamed deforestation on the tavy (shifting

agriculture) of the people living in Madagascar's eastern rainforests (see reviews in Bergeret, 1993; Jarosz 1993). The perception of local responsibility for deforestation has even pervaded the popular conservation literature. For example, Knox (1989, 81) reported that the people living in the eastern rainforest "are the forest's worst enemy, slashing and burning huge swaths of trees to clear land for crops." Only recently have Sussman et al. (1994) shown quantitative evidence that tavy (a type of slash and burn agriculture), not timber operations, accounts for most of Madagascar's recent rainforest destruction in lower elevations.

Yet while tavy may be the proximate cause of rainforest degradation, colonial economic goals probably fueled the destruction of much of Madagascar's primary forest. Jarosz (1993, 375 citing Hornac 1943) estimated that nearly "70 percent of primary forest was destroyed in the 30 years between 1895 and 1925." Beginning in the late 1880's, French colonial policies probably greatly affected environmental degradation. In 1896, Governor-General Joseph-Simon Gallieni instituted policies that assured control of the exploitation and distribution of forest resources (Raoely-James 1965; Bergeret 1993; Jarosz 1993). At the heart of these policies was the desire to harness resources that would be of great value for both export and use within the colony. Bergeret (1993, 46), for example, observed that elsewhere in Madagascar, colonial French sought controls of forest resources throughout Africa by imposing rules and reserve systems. This policy separated forest from local farmers and herders. Jarosz (1993) also noted that as the French violently conquered central and eastern Madagascar, people sought refuge in the forests. As a result, subsistence activities shifted from irrigated rice to shifting cultivation on the forested hillsides. Jarosz further stated that people sought farmland in the rainforest directly because of cash crop production. As cash-crop plantations occupied the best land, people moved into the margins, including rainforests, for subsistence farming. Thus, tavy may be a significant cause of environmental degradation. Yet ultimate responsibility may also lie with complex historical and economic forces that have changed unpredictably since the beginning of colonialism.

In the far north, however, we found little evidence that tavy decreased forest cover as it had elsewhere in Madagascar. Instead, several factors contributed to regional deforestation. First, increased amounts of agricultural land were necessary as people immigrated to the extreme north. Second, colonials, recent immigrants, large foreign companies, and impoverished local people readily exploited timber and other forest products as important sources of income. Finally, cyclones and other storms have had staggering effects on forest cover. In 1984, for example, Cyclone Camice struck far northern Madagascar and the Comoros (see Tattersall 1989). The cyclone's effects on Mt. d'Ambre were massive: forest tracts, especially around the periphery, were felled; people established villages beside this newly exposed arable land; and paths that traversed interior forest became impassable.

Afforestation and Conservation

Even as French economic and political practices encouraged the denuding of the forest, the colonial leadership recognized deforestation as a problem. The French took measures to rectify it through the countrywide interdiction of tavy in 1913 (Jarosz 1993). They also initiated afforestation projects. In 1897, Gallieni launched the first afforestation project in the high

plateau by establishing a nursery of eucalyptus trees (Raoely-James 1965). The French soon established nurseries throughout most Malagasy reserves. As in other parts of French colonial Africa, nurseries provided foresters with supplies of highly valuable tree species, including pine, eucalyptus, ebony, poplar, palisandre, and Rhizophora (Raoely-James 1965, Bergeret 1993). These trees provided important supplies of fuel wood, furniture material, and resins.

State-sponsored tree-planting campaigns continued throughout the colonial period and into the early postcolonial period. By 1965, five years after independence, thirty experimental stations had been established, and 350 eucalyptus species had been introduced. The independent government established a coerced tree-planting program, by which 21 - 55-yearolds, as part of their obligatory national service, were required to plant trees. A governmentissued socioeconomic report from 1965 states that in 1962-63, around 60% of the target population participated planting nearly fifteen million trees (Raoely-James 1965). Olson (1984) noted that reforestation campaigns during this time had been "perennial and symbolic of national self-consciousness." In 1972, this symbol of foreign domination was eliminated when a more nationalist government took over. During the 1970s and early 1980s, reforestation depended on the motivation of the local people. They could request tree-planting assistance from the national forest service. Few, however, took advantage of this service (Olson 1984).

Donor-driven conservation efforts began in the 1970's, but remained small until the late 1980's. In 1988 Madagascar's government and the international donor community, led by the World Bank, established a National Environmental Action Plan (NEAP). These organizations established that the plan would comprise three five-year phases, beginning in 1991. For the first phase alone, donors pledged nearly \$120 million (Gezon 1997b). NEAP's strategy was motivated by the recognition that forest conservation must address issues of local poverty. This coincided with a trend in the international conservation community toward funding integrated conservation and development (ICDP) approaches, in which multi-use buffer zones surround protected core areas (UNESCO 1984, Western and Pearle 1989). The goal of buffer zones is to allow people to continue to collect needed resources from specific portions of forest (usually a concentric ring around the core area). During the first phase of the NEAP, conservation projects established development projects, such as agroforestry, in the buffer zones of protected areas. These development projects help reduce the pressure on the forest in two ways: they provide desired resources from places other than protected areas, and they raise local living standards (USAID/MSI 1994).

The philosophy of the second phase of the environmental plan has shifted from the ICDP to a regional, or a landscape approach (USAID 1997, Hannah et al., 1998). This regional approach targets a broader population base, and it addresses conservation issues that extend beyond the buffer zones of protected areas. Proponents of this approach recognize the importance, for example, of corridors between protected areas and rural-urban linkages. Advocates of both the ICDP and regional approaches attempt to alleviate poverty and recognize the need for people to find alternative sources of forest products.

In practice, the administrative switch to the second phase has emphasized a move from an integrated approach (to protected area management) to a more institutionally compartmentalized one. For example, the national park service, ANGAP, has conservation as its mandate. It may, however, ask for help from other organizations in accomplishing development

goals. This means that the planners of a particular protected area may engage in the same activities as during the ICDP phase (such as tree-planting), only under a different institutional arrangement. Analyses of the effectiveness of ICDP interventions, then, remain useful in designing tree-planting strategies under the landscape approach-either within buffer zones or in other zones of conservation.

Since the late 1980's, conservationists in Madagascar adopted the protected areas gazetted in the colonial era, developing projects that conform to current conservation approaches. Protected areas were first established in the north in the late 1950's, when the government designated Mt. d'Ambre a national park, and Ankarana Massif a special reserve. The Mt. d'Ambre Project (henceforth called "the Project") was an ICDP that provided the framework for conservation activities from 1989-1997. It consisted of four protected areas, including Mt. d'Ambre National Park and Special Reserve, Ankarana Massif Special Reserve, and Analamerana Special Reserve. Then, as part of an emphasis on local management in the second phase of the NEAP, the quasi-governmental ANGAP took over the management of these protected areas as of 1997. The Project received its first international funding from World Wide Fund for Nature (WWF) and the U.S. Agency for International Development (USAID), both of whom have continued to provide a significant amount of support. A variety of nongovernmental organizations (NGOs), USAID, and Madagascar's government have continued to support both the Project and ANGAP's subsequent efforts. These efforts have received several million dollars with the mandate to maintain the quality of the environment through rural development, education, and reserve protection (Nicoll and Langrand 1989, Stuart et al. 1990, Greve 1991, Webster 1995).

Ever since the colonial era, development and conservation efforts in northern Madagascar have focused on Mt. d'Ambre for several reasons. Historically, the forested mountain initially attracted the attention of French colonials because it provided a valuable lookout post over the northern eighty kilometers of Madagascar, including the valuable port of Antsiranana. It also provided a vital outpost to administer over local people. Economically, Mt. d'Ambre supplied the French with valuable forestry products, and paved roads have long made these products easily distributed. Mt. d'Ambre has also been an invaluable watershed for much of northern Madagascar (Nicoll and Langrand 1991, Webster 1995, USAID 1997). Since the 1970's, however, conservation efforts have focused on both Mt. d'Ambre and Ankarana. Naturalists have long recognized these forests as unique centers of floral, faunal, and geological interest. As a result, both forests have drawn attention as potential revenue-generating tourist attractions. The potential stems from the belief that tourists find the nature interesting, and can reach the areas by paved roads. For each of these protected areas, conservation efforts have focused on the eastern border due to proximity to paved roads, and the areas where the greatest potential lies for ecotourism.

Although foresters have practiced state-sponsored plantation-style reforestation since the beginning of the colonial period, resource managers have only recently adopted agroforestry in their efforts at integrated conservation and development. In this section, we analyze the destructive pressures on the forests of Mt. d'Ambre and Ankarana, the ways in which conservation projects have executed agroforestry efforts, and their effectiveness in meeting stated goals. We examine tree-planting in each of these two regions, placing these cases within a

comparative international context of agroforestry efforts.

PRESSURES AND FOREST USE PRACTICES

Mt. d'Ambre

Land use and forest disturbance around Mt. d'Ambre vary greatly (Table 1). The interior and west are where humans have least disturbed the forest, as roads do not lead directly to them. No people inhabit the interior; those living west maintain small farms on irrigable land near the rivers that lead from the forest. Perhaps the greatest forest pressures come from both stray and domesticated cattle, which disturb undergrowth. Herds of stray cattle ranged in the interior, at least since the 1984 cyclone. Domesticated cattle most commonly inhabit western forest during the dry season, when water and lush new growth are unavailable in the adjacent savanna. Otherwise, Freed found no evidence of agriculture, logging, or charcoal production in these forest regions. Other potential pressures here are cyclones and neighboring forest disturbance.

All other areas of the forest, however, are readily accessible by road, and are subject to varying degrees of agriculture, logging, charcoal production, hunting, and tourism. Agricultural practices vary around Mt. d'Ambre. For example, the northeast contains large pineapple plantations in former forest land (by Sakaramy), mango and banana plantations, riverine rice plots, horticultural plots beneath the forest canopy, and intensive agricultural plots near Joffre-ville. To the east, villages expanded agricultural plots into cyclone-felled areas along the forest edge. Other villages developed farmland along the rivers that flow from Mt. d'Ambre. In the northwest where the forest is drier, many people have routinely felled trees and produced charcoal. Cyclones and humans have felled the southernmost region steadily over the last forty years.

Rousettes is the only village fully contained within the forest, and only forestry workers and their families live there. In addition to pressures from subsistence gardening, his region has been subject to intense tourism and hunting throughout the last century. The French established the village as a forestry outpost, and constructed a road for tourists from Antsiranana. Tourists have provided an infrequent income source for the forestry service. Yet tourism has never been benign to the wildlife. Hunting was unenforced even as recently as 1989. Roads and paths made accessible otherwise relatively protected forest. Endemic flora has been replaced with nonnative species, including mangoes, citrus, and other fruit trees. Finally, lemurs were provisioned to assure that recent ecotourists would see them.

People have attempted reforestation in Mt. d'Ambre since colonial times. The colonial French established nurseries where they introduced, raised, and transplanted many species, including pine, eucalyptus, and palisandre. Pine and eucalyptus are fast-growing trees that rapidly deplete soil nutrients from neighboring growth, especially undergrowth. Foresters rapidly introduced these trees to areas most susceptible to deforestation. For example, pine trees have served as a buffer to protect or demarcate the eastern forest edge. Also, a pine forest now leads tourists from Rousettes' humid rainforest to the most spectacular region of Mt. d'Ambre, the Grande Cascade. Deforestation from the northwest has threatened this touristed region. Local people also reported that the forestry service sold pine trees to Antsiranana for Christmas decoration and woodworking. In contrast, foresters planted eucalyptus as fuel wood in both Rousettes and in the northeast. The introduction of this species may have also slowed deforestation near Sakaramy by relieving pressure for fuelwood. The French also introduced palisandre, a hardwood used in furniture-making. This species is now found throughout Mt. d'Ambre. In short, French colonials raised those species that they could grow rapidly, transport readily, and sell easily in markets.

Ankarana

Land use practices around Ankarana are also diverse. Due to the limestone massif's topography, a series of sharp spikes that Malagasy call tsingy, much of the biologically diverse forest lies in inaccessible crevices within the Massif. Thus, the forests outside these regions are most at risk. The forests northwest of the Massif are relatively protected, however, and humans have had little overall impact on forests in this region. Overall, the pressures on Ankarana's forest consist of a history of localized small-scale selective logging and local use of the forest as a source of fuel wood, construction wood, shelter for cattle, and medicinal plants. Aerial photographs show that despite these pressures, the forest near Gezon's primary research site remained intact - and even expanded - between 1949 and 1990. Ground observations, however, reveal that many forest patches lying between the massif and the villages (officially outside of the protected area) consist of degraded scrubby secondary growth. Since these degraded patches lie closer to the village than the forest surrounding the massif, they serve as a primary source of fuel wood, construction wood, and other local needs, thus relieving the pressure on the protected forest. People also carve gardens out of the scrubby areas nearest the village. There, they plant bananas, cassava, beans, and other food plants for household consumption or local sale.

In northwestern Ankarana, population density, the fertility of local farm fields, and the location of villages have contributed to forest protection. Irrigated rice fields in the fertile alluvial soils have provided well for the small number people who live there. If the population exceeded what these rice fields could support, people would most likely prefer to farm tillable open grassland, not the forest. Whereas the grassland occurs near villages, forest lies several kilometers away, and is more difficult to clear.

Pressures on the forest are more intense in the southwest. Local people have used the forest as a source of construction wood, medicinal plants, and as a sacred ritual site (Gezon 1997b). They have also cleared forest to make fields for growing rice. Around the royal Antankarana village, for example, people were actively transforming forest into farmland in 1993, despite the presence of the Project. In contrast to the northwest, southwestern people do not use irrigation, and the soil is markedly less fertile. As a result, harvests are also much smaller per unit than in the northwest. Even though population densities are not high in this area, the southwestern land has supported fewer people. Cutting down the forest for fields - or farming on previously cleared fields - has increasingly become vital to many people. Once people invest the labor in clearing a field, they rely on it for their overall harvest. Because these fields are located between one and two kilometers away from the village, many farmers build homes that they occupy

during the growing and harvest seasons. Thus, people have considerable initial and on-going investments in these fields.

Several other methods of cultivation have supplemented the harvests from these southwestern forest-cut fields. Local people used tractor-drawn plows on permanent fields located nearby the village. They have also transplanted rice into plowed areas of the grassy plain that collect water during the rainy season. In summary, many southwestern people farmed several small fields, using a combination of planting techniques. Depending on the day or season, people may spend their time transplanting seedlings, weeding tractor-plowed permanent fields, or clearing new fields.

South of the Massif, pressure on the forest stems from the conversion of forest to sugar cane fields. Proximity to roads and to a sugar processing plant west of the town of Ambilobe has made this an attractive use of land. Based on aerial photos from 1949 and 1990, many hectares have been converted this way. The forest that remains today - and that is being protected - is small compared to the amount already cut. Many local people, recognizing that clearing the forest is no longer viable, would still like to use the remaining forest as a source of construction wood. As a result, their lack of access to the protected forest fueled a reluctance to cooperate with the Project.

The Project

Agroforestry has been a core component in a multifaceted approach to conservation during the ICDP phase. This analysis focuses particularly on the period from the late 1980's to the mid-1990's, when conservation was managed by the Project and the ICDP was the major form of intervention. Critiques of agroforestry under the Project can, however, serve as general guidelines and warnings for conservation-oriented agroforestry either in northern Madagascar or elsewhere. Many of the suggestions remain relevant within any administrative context. In addition to agroforestry, the Project also attempted to police illegal activities, and to educate and train local extension agents and tourist guides. To our knowledge, rural development projects (i.e., income-generating activities and improved agropastoral techniques) were confined to road-accessible regions near Mt. d'Ambre. The Project was, in fact, accused of emphasizing conservation rather than development activities (Hough 1994a). In an attempt to generate local support for conservation, the Project hired local people in key villages as Agents pour la Protection de la Nature (APN). Unarmed APNs were trained to police protected area boundaries and to report infractions. They were also expected to serve as primary agents for training locals, and to generate local enthusiasm and willful compliance with Project goals. APNs were given salaries (thus theoretically relieving them from the need to farm), uniforms, and bicycles.

The Project also hired people to run tree nurseries in several villages. These people were given a small salary, but were also expected to continue subsistence farming. The goal of the nurseries was to provide local people with such products as construction wood, fuel wood, and fruit. The trees were also to stabilize the soil, as well as provide shelter in the villages and around their rice fields. As a major player in the Project's organization and management, WWF used a common scheme when they organized similar tree nurseries in other projects within

Madagascar. WWF would first hire a local person to run the nursery, and then organize community tree-planting days, during which they would encourage locals to plant trees on their land (Durbin and Ralambo 1994).

The Project applied the same agoforestry principles to Mt. d'Ambre and Ankarana. In 1989, it began maintaining the national forestry service's nursery operation in Rousettes and northeastern Mt. d'Ambre. Closely-related villagers from Rousettes and Joffre-ville worked existing nurseries. The Project attempted to distribute information and seedlings to local people, but the effectiveness of the program was not apparent in 1991. Throughout this initial phase, more than twenty prominent household heads could not state clearly how this agroforestry effort had benefited them. Despite the lack of positive results, overall perception of the Project faltered when people in other Mt. d'Ambre buffer zone villages perceived that Rousettes and Joffre-ville were unduly privileged. As one village leader in western Mt. d'Ambre asked Freed, "What do we need to do to receive this attention or money? Cut down the forest like those in the northwest? Cut down the forest so we can farm as they do in Joffre-ville?"

Gezon observed the same technique when it was applied to her study site, the Ankarana village of Bevary. There, the project hired two APNs and one tree nursery supervisor. The APNs were brothers and the nursery supervisor was their cousin. In the royal village, there were no project employees, and in the south, there was an APN and a nursery. When Gezon first arrived in the northwest in late 1992, the tree nursery thrived under the supervision of Henri, a Project employee. He kept the small plastic bags with seedlings of eucalyptus and fruit trees near his home and watered them regularly. The other villagers knew of his activities, and they seemed to have a vague recognition that the trees were eventually to be given away to be planted. At one point, a Project educational team held a village meeting in which they informed people of the value of the trees and forest. Eventually the day arrived when Henri distributed the trees. Anyone could claim some trees, with the understanding that people would plant and look after them. Henri did not have difficulty distributing the trees. Children planted some near the school as a class project, and others took them to plant somewhere on their property. No one ever made reference to the trees again.

A return visit in 1999 revealed that many of the eucalyptus and fruit trees had survived. When asked about the tree-planting project in retrospect, people gave varied responses. One young man said that Project officials had told them that if they wanted to continue to be able to gather construction materials from the nearby forests, they must agree to plant some of the trees on their property. Another said that he had planted the trees because it had seemed like a good idea at the time, although he had no use for the eucalyptus and did not imagine needing it in the future. When asked if it was a useful project, many said that they liked the fruit trees and would like to see more of them.

Effectiveness

In both sites, the project was successful in maintaining tree nurseries and in distributing trees. Yet in neither site did the project initially appear to be successful in establishing a sustainable strategy that engaged the local people in addressing specific conservation needs. Several reasons contributed to the limited success of the Project, including: local people's lack of

a felt need for obtaining trees; their insufficient participation in designing and implementing the project; their lack of identification with the Project's goals; and lack of Project engagement with local decision-making processes.

In analyzing the effectiveness of these efforts, we examine agroforestry within a comparative international context. We focus on local people's interest and participation in treegrowing, issues of land tenure and social organization, and the distribution of benefits and costs within and between communities in local tree-planting endeavors.

Adoption and Participation

A vital component of any agroforestry project is that local people must identify an interest in obtaining trees. Critical to conservation is that human activity must reduce pressure on existing resources. For example, although people in Ankarana desired fruit trees, few people saw the trees as an alternative source of fuel and construction wood. In Mt. d'Ambre, the agroforestry activities may actually have alienated people further from the Project because of intercommunity rivalries. In Bevary, people felt little need for more trees, since they continued to meet their needs for construction and fuel wood from forest both inside and outside the Project's protected area. The local APNs reported violators and often confiscated their wood, but enforcement was difficult, especially since the APNs sought to maintain their favorable perception in the eyes of kin and neighbors. Thus, local people at both sites viewed APNs as police, not as sympathetic extension agents.

One difficulty with conservation-related agroforestry is that the desire to plant trees corresponds primarily with international conservation goals, not necessarily with local perceived needs. As Kottak (1991) has found, projects that provide what people desire have a higher success rate than do those that propose solutions to problems local people have neither recognized nor embraced. People who recognize the need for trees engage more willingly in foreign-initiated agroforestry projects. Castro (1991), for example, observed that certain Kikuyu in Kenya have practiced agroforestry for decades. They have actively sought solutions to their dual and contradictory needs for trees and land. In Haiti, people did not practice agroforestry, but their need for fuel wood became so severe that they welcomed the opportunity to experiment (Murray 1987).

Yet in northern Madagascar, local people generally had no inherent interest in growing trees. Only in southern Ankarana did people express a shortage of tree products. But this lack of construction wood came not because local people found no suitable trees. Rather, the Project forbade their use of existing trees in the protected area. Thus, local peoples' animosity to the Project's goals quickly arose, and it prompted local resistance to Project-initiated agroforestry. Lack of interest in the trees as alternative sources of fuel wood was perhaps the single most significant reason for the lack of lasting impact of the Project in Ankarana.

When using agroforestry as a means for conserving existing resources, then, projects may need either to generate an interest in tree-planting or to embellish fledgling interests. One of the difficulties, Cernea (1991) observed, is that a cognitive shift is necessary, where people see themselves as producers - not harvesters or gatherers - of construction and fuel wood. That the Project did not have problems giving the trees away in Bevary suggests that the people needed no additional incentives to plant a limited number of trees. That few of the planted trees were targeted for construction or fuel wood suggests that the people would need greater incentives to cultivate them as a resource. Some scholars have found that where there are capitalist economic incentives and manageable risk, people are more likely to adopt agroforestry practices (Scherr 1995, Suryanata 1994, Tisdell and Xiang 1996). Some have even stated that agroforestry programs must be economically attractive to be successful. Hosier (1989, 1835) stated that "it is the production from agroforestry systems that makes it an attractive land-use system for farmers, not its environmental benignancy." However, Suryanata (1994, 1568) cautioned that although agroforestry loses some of the properties that earn it the reputation of being a sustainable system." Caution must be maintained in balancing the benefits of marketing tree products with the costs, especially the potential increased pressure on both land and social relations.

Sometimes the sale of tree products is commercially viable. For example, Hosier (1989) found that people in Kenya grow trees for sale as poles used in construction. The French colonials also tried to exploit commercially at least three forest resources in Mt. d'Ambre: pine, eucalyptus, and palisandre. In contrast, we saw no evidence that recent agroforestry efforts in northern Madagascar have focused on the long-term commercial viability of tree products. Nonetheless, given the population growth in Antsiranana, local people could probably profit from the sale of agroforested construction and fuel wood to the nearby city-dwellers.

Southern Ankarana lies close to a well-traveled road to Ambilobe, and may also have success in marketing tree products. Villagers (especially children) already collect cashews from trees scattered on the countryside to sell to wholesalers. Therefore, they may welcome more cashew trees on their land. But in northwestern Ankarana (the region of Bevary), local people may be less interested in marketing agroforestry products because of distance from paved roads, local availability of wood, and a lack of a history of commodification of tree products in the rural areas.

Yet in western Kenya, Scherr (1995) found that agroforestry yields increase not just where direct market incentives exist. Local people are also likely to adopt tree-planting if they perceive: a decrease in the number of available trees; an increase in local subsistence-level demands for tree products; and a perceived risk of livelihood-endangering environmental degradation. Scherr emphasized that people do not just strive to maximize profit. They also try to meet multiple household goals, including savings and a secure supply of household needs.

If local people of Mt. d'Ambre and Ankarana begin to perceive a shortage in necessary tree products, they may become receptive to agroforestry as an alternative source of wood. To encourage the adoption of tree-growing practices, Project planners must establish a rapport with target communities. They must work with local people to design and carry out a program that assures local subsistence needs in a sustainable way (Grimm and Byers 1994, Kottak 1999). Intensive participation with local people is important for several reasons. First, Project leaders may better identify how political and economic frameworks influence an individual's ability to adopt a scheme (Suryanata 1994). Second, leaders will better comprehend how knowledge of local divisions of labor are essential for developing a plan to sustain care of the trees. Another reason is to identify those species (or qualities of species) that commonly and best suit local needs and interests. Some scholars have encouraged the use of native species mainly for environmental reasons, but also because of some case-specific local interest in them (Butterfield 1995, Wright 1997, Richardson 1998). Others have noted the importance of identifying qualities, such as hardness of the wood or compatibility for intercropping, in selecting trees for nurseries (Stevens 1993, Newman 1997).

A final reason to emphasize local participation is that the alternative is to enforce regimented schemes, and this has not had positive, sustainable results. Mgeni (1992), for example, showed that the post-independence Tanzanian Village Afforestation Programme (VAP) emphasized community self-help, but in fact it coerced local people to plant village woodlots. This top-down approach ignored local needs and interests, and it failed to alleviate fuel wood shortages. Similarly, both the French colonial government and the postindependence regime in Madagascar mandated the planting of trees as part of a citizen's civic duty. Some rural people living around northern Madagascar's protected areas recall having had to participate in this. The association of tree-planting with top-down schemes may contribute to their reluctance to take ownership in the goals of current planting activities. With careful, consistent interaction between locals and project officials, this lack of communication need not be permanent.

An important reason for the limited success of the Project is that rapport between citybased project officials and local people has been neither consistent nor thorough. Even during the initiation of the Project in the late 1980's, leaders merely informed local people of the Project's existence instead of working with local leaders to establish it. In both Mt. d'Ambre and Ankarana, hiring local APNs and nursery supervisors was the initial step toward local participation. But people - even those whom the Project employed - remained unclear as to the purpose of the seedlings within the context of the Project. They knew that WWF liked trees, lemurs, and birds, but they did not see themselves as engaged in the endeavor to save the forest. In Bevary, the educational team from the project arrived in the village only once or twice in 1993. In both sites, local people often felt the team's presence more as a show than as the interactive and familiar dialogue that would be necessary to carry out a viable agroforestry strategy. Instead, discussions should occur regularly and often, not just at specially-orchestrated events.

Establishing positive communication requires familiarity with local political organization. In Ankarana and along the western side of Mt. d'Ambre, two types of leaders prevail: the royal indigenous leadership of the Antankarana Ampanjaka and the patrilineal/village elders. Ever since the beginning of the Project in 1989, Project leaders have been aware of the need to work together with the Antankarana leadership. They have continued to hold discussions with the Ampanjaka and to participate in ceremonies aimed at pleasing the ancestors (Gezon 1997a). While formal ceremonies and diplomatic ties with an indigenous leader are critical, however, they are insufficient for establishing working relations with local people. In all but the most immediate area at the southwest of the Ankarana region, for example, the Ampanjaka does not definitively govern access to local resources. Even within that restricted area, the local people do not always agree with the Ampanjaka's decisions regarding the use of local resources (Gezon 1995). In many of the villages surrounding the protected areas, heads of dominant patrilines (especially men, but also women) take the lead in public decision-making. Decisions are made by consensus during public meetings of the smallest state-recognized political unit at the time, the fokontany (generally consisting of one large village or several smaller villages). The official president of the fokontany need not be a respected elder. In 1992-3, the president of the fokontany in Bevary was the school teacher-a known alcoholic who was not respected by the community. The village elders seemed to enjoy having him responsible for signing official fokontany documents, allowing them to remain powerful, yet invisible. On the other hand, in Joffre-ville, the presidents of fokontany in 1989-92 and at present have been highly respected members of the community. Despite the ambiguous position of the president, the fokontany provided (and continues to provide) the context for decision-making between and patrilines at the village level in the Ankarana region and on the western side of the Mt. d'Ambre.

The Project personnel seemed aware that the fokontany was the main arena for formal, village-scale decision-making. In 1999, for example, a member of the ANGAP staff who had previously been with the Project from its inception mentioned that it had been relatively easy to mobilize people in those regions by making an appearance before the fokontany. But the Project did not appear to act on this in designing the agroforestry intervention. In the case of the Bevary, the Project did not actively engage the elders beyond asking for permission. The villagers confirmed that Project officials had indeed told the fokontany of their intentions, but they made all other decisions (such as who to hire, where to establish the nursery, how to distribute and care for the plants) on their own. Future attempts must experiment with a more fully participatory process - one that recognizes the role of local leaders in the adoption and maintenance of new practices. Local leaders must be considered critical sources of suggestions and feedback in an iterative process of program design and implementation.

LAND TENURE AND SOCIAL ORGANIZATION

A second critical component in developing an effective agroforestry project is recognition of the sociocultural context of the target area. Local configurations of land tenure, social organization and divisions of labor can strongly influence the outcome of a project. After discussing these issues in a broad comparative context of international agroforestry interventions, we will specifically discuss the northern Madagascar cases and the particular issues related to protected area management.

The relationship between land and tree tenure and resource use practices has been the subject of significant scholarly attention (Raintree 1987, Fortmann and Bruce 1988). Bruce and Fortmann (1988, 1) drew on Henry Maine's (1920) concept of tenure by defining it for agroforestry as "rights to use land, trees, and their products in certain ways and sometimes to exclude others from use." Cultural concepts of rights to resources vary considerably (Okoth-Ogendo 1987, James and Fimbo 1988), and motivation for planting and caring for trees can be directly linked to the way that they are owned and managed. This can have implications for agroforestry projects in establishing individuals, households, village collectives, or other associations as the owners and/or caretakers of trees. Sometimes agroforestry projects have erred in making entire villages jointly responsible for the care of trees in community woodlots.

Cernea (1991) suggested that the term "community forestry" is naïve, because it assumes an undifferentiated group and ignores the particular division of labor through which trees are planted, cared for, and harvested. It also assumes joint, as opposed to individual, management to be most productive. This miscalculation has led to the failure of many projects.

Agroforestry planners and researchers have also explored individual private ownership or household management of trees (Cernea 1991). In this shift, communities are now regarded not as collective wholes, but rather as larger units that are made up of individually motivated economic units or actors. Not only does this shift question the relevance of the group at the village level, it also questions the role of central governments in the management of subsistence resources (Thomson 1987).

One reason for questioning the involvement of the state in local resource management is that it can lead to confusion about rights to resources (Okoth-Ogenda 1987). In Madagascar, the socialist government decentralized forest ownership in 1978 after villagers had complained about their rights having been taken away. Village collectivities were then given ownership, and federal agencies retained technical and managerial control (Olson 1984). For the villagers, this has meant that they theoretically owned the forest domains outside the protected areas. Yet they still must request a permit before cutting trees for, say, construction wood. Those influencing conservation policy have decried such local-state overlap as a source not only of uncertainty over individual rights, but as a disincentive for people to conserve forest resources. As one report stated, "this lack of confidence [over rights] leads to a situation where the user believes he or she must use the resource today for fear that either it will not be there in the future, or that future access to it will be cut off (Leisz et al. 1995, 60-61)." In response, conservationists have emphasized individual rights, and international funding has contributed to state efforts to assign individual titles to the users of land around protected areas.

Complications can arise, however, when planners assume that motivation is best guaranteed by establishing individual property rights. Effective management of common property has been demonstrated in many places (McCay and Acheson 1987, Peters 1994, Freudenberger et al. 1997). Okoth-Ogenda (1987) suggested, for example, that in contrast with English property law, exclusive individual ownership of property is unknown in Africa. As an example of community-based resource management, Grandin (1987) discussed the cooperative management of pasture resources among the Maasai of East Africa, which is based on long-term mutual social obligations. Grandin argued that a local agroforestry project should explore the possibility of creatively adapting these social networks in devising a way to meet needs for dry season fodder.

In any case, the proper social unit to be responsible for maintaining trees cannot be broadly proscribed, since it must be compatible with existing sociocultural and politico-legal frameworks (Benneh, 1987; Steinberg 1998). But social organization is never static, existing relationships can form the basis for creative new syntheses. Cernea (1991), for example, paralleled Grandin in advocating the formation of social groups (based on age, gender, kinship, or common interest) appropriate to the management of tree resources. Agroforestry projects, as with all development interventions, have complex sets of social relationships that extend even beyond local geographic boundaries. They are not just sets of scientific and technical solutions to material problems.

In northwestern Ankarana and western Mt. d'Ambre, cooperation is based primarily on collaboration in farming and herding activities between patrilineally-related households either within the village or in nearby villages. In Bevary, recent immigrants may work with each other or with members of existing patrilines. A less common form of cooperation was between similarly-aged men, who formed associations and together harvested each other's or other people's rice fields for a set fee (Gezon 1995). The most important way the patrilineal work groups pool their resources was in bringing their cattle together to till the soil and to trample the cut rice. For the other tasks, the individual farming household took charge of calling others to help them. For example, the women worked together to pull weeds, to tie the rice, and to winnow it. For their labor, these women would be compensated with a basketful of paddy at harvest. Single women often took advantage of these opportunities, since many did have a field of their own.

Kottak (1999), who visited Joffre-ville (eastern Mt. d'Ambre) in the early 1990s, also suggested that local school, ethnic, and religions associations may be used to implement projects in that area. While such associations have not tended to be as successful in Madagascar as in other parts of Africa, groups in Joffre-ville have formed at least since 1989 with mixed success. In the early 1990's, for example, a religious group worked with local people to raise small garden plots. In 1999, a local woman also reported that a women's group had been effectively implementing small-scale economic development projects. Specific data on the success of these measures is lacking at this time, however.

As part of a plan to protect biodiversity, buffer-zone agroforestry efforts must contend not only with getting people to plant and care for trees, but also with the larger legal framework of land tenure. The perception that individual ownership leads to conservation of resources has led to the urgency of issuing individual titles to land. Because of this, agroforestry planners in Madagascar may be less flexible in working with local people creatively to form groups appropriate to the management of trees. Since in most instances households are primary economic units in the Ankarana region, it did, in fact, make sense for the Mt. d'Ambre Project to distribute trees to individuals, who in turn planted them on land maintained by the household. But, given the lack of long term interest in tree-planting, it may be ideal for project officials to experiment with other ways of designing agroforestry interventions.

Local land tenure practices support cooperation within and between households. Usually, people hold individual titles for land, but some patrilineages jointly own land. In these cases, the rights to farm are passed between siblings. For example, a prominent patriarch in Bevary died, leaving nine living children to inherit several hectares of irrigated rice fields. Since there was not enough for each of the children to inherit land separately, they agreed to take turns managing the fields (Gezon 1995). Villages manage the surrounding land as a commons, with patrilineages holding customary rights to certain patches of land. When an individual clears land for a garden or digs canals for a new rice field (an unusual occurrence), rights usually transfer from the patrilineage to the individual.

Based on knowledge of these land tenure and cooperative work practices, we suggest that agroforestry efforts may be most successful when ultimate rights and responsibility are held either by an individual or by a household. Owners could then call on others for help if labor requirements were too great for a single individual or household. Since people already plant some tree crops on land used for gardens (especially banana plants), agroforestry planners may employ the concept of the garden in developing potential sites for small household treelots. These treelots could form part of an overall agroforestry strategy that includes trees planted for protection of rice fields, shade, and fruit. Despite our experience with cooperative practices in several target locations, we recognize that agroforesters must define the best unit of cooperation for individual projects. Project planners can do this by working intensively with target communities during design, implementation, and evaluation phases.

Distribution of Benefits

A final caution is that scientific agroforestry models, if they do not carefully examine the socioeconomic and cultural context, may privilege dominant groups and contribute to the further marginalization of others. Forestry models in the past have focused on meeting colonial interests (Bryant 1994). In Madagascar, plantation-style forestry for cash crops pushed local people to marginal lands. But even in agroforestry systems, which were designed to mitigate against these inequities, certain members of local communities have reaped the majority of benefits, usually at the expense of women (Rocheleau ; Schroeder 1994) and itinerant populations (Brokensha and Riley 1987, Fortmann, Wells and Brandon 1992). Especially where valuable markets exist for tree products, involvement in agroforestry intensifies socioeconomic stratification both within and between households (Suryanata 1994). So pervasive is this problem that some have cautioned against assuming that agroforestry is of value in all contexts (Rocheleau and Ross 1995, Schroeder and Suryanata 1996).

Several issues of equity face agroforestry planners in northern Madagascar. First, within each community, agroforestry planners should have accounted for local inequities that resulted from kinship and divisions of labor. In each site, people from one family became privileged recipients of information and Project funds. For example, in Bevary, the Project should have recognized each of the three dominant patrilines, as well as from the newcomers (vahiny), instead of hiring only members of one family. In both sites, the Project did not account for local divisions of labor. Local women particularly received neither salaries nor information and training relevant to their needs and interests. Had the Project addressed these intracommunity issues immediately, it would have encouraged broader participation and interest in its activities.

Second, at the intercommunity level, a concentration of efforts within a single village resulted in the envy, and perhaps intransigence, of surrounding villages. In Mt. d'Ambre, the Project team initially targeted most efforts on specific regions. The team failed to discuss and listen to local people in many communities surrounding the forest. Favoring one region over another is especially risky in biodiversity conservation, since ICDP efforts rely on the compliance of all communities surrounding a protected area. The solution to this is not easy, since any development project covering a wide geographic region must choose whether to intensify activities in several sites or to spread themselves so thinly as to reduce any hope of effectiveness. What is minimally needed in seeking sustainable resource use is greater communication between communities. At a minimum, project planners should facilitate dialogue among fokontany leaders within the targeted region. Moreover, Project activities

should focus not on historical preferences for people or communities, but on meeting the specific resource needs of individual communities and regions.

CONCLUSION: LESSONS FROM HISTORY IN AGROFORESTRY PLANNING

Each of the northern Madagascar Project areas was partially successful in that local paid employees maintained nurseries and gave away trees. It seemed, however, that neither established a sustained agroforestry program that could reduce pressure on forests by providing an alternative source of tree products. Many of the difficulties facing the Project are not unique to conservation-related agroforestry. As with other projects, they face the challenges of ensuring adequate participation, and paying attention to the needs of women and the landless. They both face the irony that the motivation to engage in agroforestry, when it is based on the ability to sell the products for a profit, may prevent the project from being sustainable. Both types of projects must also look beyond immediate pressures on forests in order to understand how land tenure, market incentives, and even international lending policies encourage certain land use practices (Larson 1994, Kull 1998, Rappel and Thomas 1998).

Yet conservation-oriented agroforestry faces some unique challenges. The first regards the effectiveness of agroforestry in furthering the conservation of resources, both within and outside of protected areas. Even if an agroforestry program is successful in terms of producing mature trees, the question remains as to whether or not it is effective in meeting the goals of conservation. Wells and Brandon (1992), in critiquing the ICDP approach, note that raising economic standards of living will not automatically reduce pressure on local resources. In the Mt. d'Ambre, for example, agroforestry trees would not make planting in the forest less attractive. In other words, it would not eliminate the motivation to degrade the forest. For the region of Bevary, a successful agroforestry project may reduce pressure on non-reserve forest stands. It would do nothing, however, for reducing pressure from cattle or from small-scale selective logging by non-locals. To the southwest of Ankarana, an agroforestry would not alleviate the intense pressure from the transformation of forest to field. To the south, a successful project may in fact provide an alternative source of construction for the local people, although selective cutting for construction wood was not the original cause of deforestation.

Conservation planners must remember that agroforestry is not a universal solution to habitat degradation (Tinker 1994). Recent conservation planners have focused heavily on agroforestry in an attempt to address what they have perceived to be the cause of deforestation in Madagascar. Indigenous land use practices, such as tavy, have been blamed for forest destruction from colonial times until the present. Planners have inherited this perception in part from historical concepts of forest exploitation and management. Colonials, for example, used plantation-style reforestation as an attempt to compensate for deforestation from indigenous agriculture. Today, emphasis has shifted to agroforestry projects, which attempt to remedy deforestation by providing small landholders with trees so that they no longer need to degrade the forest. Yet a blueprint strategy of conservation-oriented agroforestry projects will not contribute to protecting resources in all cases. Where agricultural land is the greatest local need, for example, an inflow of trees will not remove the incentive to cut down the forest. Planners need to recognize the history of particular approaches before automatically adopting them. No matter what the cause of deforestation, it would be valuable to initiate agroforestry projects if local people express an interest them. But as an effort to reduce pressure on forests, agroforestry should arguably be actively pursued where the danger to the forest arises from local exploitation of tree products.

Complex historical factors also contribute to local (mis)understandings of a project's objectives. The Project in northern Madagascar, for example, was operating in an area of heavy colonial and post-independent state influence. This affected the local people's perceptions of the project and their reactions to it. In the absence of an intensive participatory approach on the part of the Project, local people were left with their preconceived notions of foreigners and their development projects. In the case of Mt. d'Ambre, local people were familiar with the nurseries and the reforestation activities of the French colonial outpost at Joffre-ville. They associated the French with the powers of enforcement, taxation, and land take-over. The Project in many ways resembled this characterization, in that it claimed jurisdiction of the protected area; its employees were hired to enforce its boundaries; and that it was concerned with nurseries and reforestation with exotic species. In Ankarana, even though many had a rather benign perception of colonialism, some remembered with disfavor the coerced planting campaigns of the 1960s and early 1970s. Their perception of agroforestry projects, then, may on some level be tainted by this unpleasant memory.

Agroforestry projects have suffered in both Ankarana and Mt. d'Ambre because of their association with the state enforcement capacities and wealthy foreign interests, both of which they had experienced since colonial times. The local credibility of the nursery supervisors remained low because of their close links with the APNs, who were Project-employed enforcement agents. As a result, the village-level supervisors do not inspire broad enthusiasm for conservation activities. The case of resentment against APNs in Bevary suggests that agroforestry planners be aware of the difficulties in assigning development roles to enforcement personnel and their close associates (e.g., nursery workers).

Furthermore, the Project's association with expensive equipment and an inflow of money interfered with its ability to accomplish its goals. Rather than generating grassroots interest in sustainable development, such a presence tends to lead merely to a desire to get some of the goods for oneself (schools, bicycles, or-in this case-trees) (Grimm and Byers 1994, Gezon 1997b). As Hough (1994b) observed in Benin, an approach that combines compensation (with vehicles, equipment, etc.) with intensified law enforcement will be unlikely to provide sufficient motivation for local people to develop sustainable resource use practices. Also worth noting is that any conservation-oriented agroforestry project may have profound difficulties in obtaining genuine local participation if people see conservation planners as barriers to existing trees.

Agroforestry around protected areas cannot change a history of tension. Conservation planners, aware of histories of land use practices, can work with local people in meeting needs for tree products. To begin with, they can design projects together with local people, paying attention to such factors as local divisions of labor, land tenure, and desired types of trees. Furthermore, they can explain their interventions in terms that make sense to people, emphasizing the economic value of the forest for agriculture, for example (Kottak 1999). Although the second phase of Madagascar's environmental plan has institutionally separated conservation and development activities, planners should not underestimate the importance of integration. Richard and O'Connor (1997) are correct in observing that the value of integrating conservation and development lies "in engaging local communities and their expertise effectively in the pursuit of conservation objectives (412)." In the case of northern Madagascar, this means that proponents of the landscape development and conservation approach must seek and actively engage elders, fokontany leaders, members of politically marginal groups (e.g., women, recent immigrants), and community groups local to targeted regions. Just because buffer zone agroforestry projects have only had partial success in the past does not mean that they should be rejected outright. The experiments of the past decade should instead guide future agroforestry through a flexible, iterative process. While there are merits to including regional perspectives in conservation approaches (Hannah et al. 1998), replacing one overall strategy with another will not suffice to correct past errors of ignoring local land use histories and practices.

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Figure 1. Map of field sites in northern Madagascar.



Figure 2. Towns, cities, and regions of the study sites, Mt.d'Ambre and Ankarana.

Table 1: Regions of Mt. d'Ambre.

Region & Elevation (meters)	Climate	Forest	Accessibility	Nearby Towns & Cities	Forest Pressures
Northwest (300 - 700)	Dry, warm	Dry, continuous North: Patchy	Paths to many communities	Mangoaka	Logging, hunting, charcoal
Northeast (200 - 800)	Dry, warm (Low Elev.) Humid, cool (High Elev.)	Dry & humid areas, continuous	Roads to cities; Paths in forest	Joffre-ville Sakaramy Antongobato	Agriculture, horticulture, hunting
Rousettes (950 - 1050)	Humid, cool	Humid, continuous	Road to cities; Paths to most regions	Rousettes	Tourism, garden plots, hunting, pine & eucalyptus
East (800 - 1100)	Humid, cool	Humid, continuous	Paths to villages	Ambahivabe Sadjoavato	Agriculture, villages
South (500 - 1200)	Dry, warm (Low Elev.) Humid, cool (High Elev.)	Dry & humid areas; Some patches; Mostly continuous	Paths to communities	Anivorano- Nord	Southern limit felled; Cyclone or humans
Interior (1000 - 1475)	Humid, cool	Humid, continuous	No paths during 1984-91; few paths presently	None	Cattle
West (600 - 1100)	Humid, cool	Dry & humid areas; continuous	Southwest: Easy access; Few other paths	Andr'vanjava Bobakilandy	Cattle Southwest: Farming