

**The cost of ignoring rules:  
How Madagascar's biodiversity and  
rural livelihoods have suffered from  
institutional shortcomings**

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## INTRODUCTION

### The Deforestation Puzzle

Beginning in the mid-1980s Madagascar caught the attention of the international community due to the alarming deforestation rates experienced by this biodiversity-rich island (Green and Sussman 1990; Horning and Nelson 1991; Sussman et al. 1996). At the same time, Madagascar was also one of the poorest nations in the world.

As development and conservation proponents faced the vexing issue of forest depletion and the environmental degradation that came with it, explanations emerged as to what could be done to slow down this degradation and the loss of biodiversity that ensued. Starting in the mid- to late 1980s, foreign donors began to collaborate with the GOM to stop the “spiral of environmental degradation.”

It is important to point out at the outset that motivations for addressing the problem of environmental degradation have not always been the same for foreign donors as they have for the Malagasy government. Interest in preserving the environment initially appeared to favor conservation for its intrinsic value for conservationists, while Madagascar’s 1990 environment charter calls for integrating environmental conservation into the country’s development.<sup>2</sup> Over time interactions, experiences and negotiations resulted in political and financial agreements that took the concrete form of conservation projects. Curiously, these negotiations over environmental protection did not involve resource users until the late 1990s (ONE Mission Statement).<sup>3</sup>

### Identifying the Culprits

Meanwhile, the culprits were identified: farmers who depended on forests, who were poor, growing in numbers while remaining uneducated, were largely responsible for deforestation. For many decision-makers it thus stood to reason that improving the socio-economic conditions of rural people living near forests should result in successful conservation. This view subscribes to the “win, win” logic whereby livelihood improvement and environmental protection are assumed to be compatible and mutually reinforcing, as was embodied in Integrated Conservation and Development Projects (ICDP) (CIIFAD 1997-1998). Under the logic of ICDPs, a core area is designated as off-limits, while the buffer zone, is reserved for subsistence uses. In Madagascar, financial support for ICDPs was secured through the US Agency for International Development (USAID) and the Malagasy government starting in the early 1990s.

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<sup>2</sup> « Cette politique nationale de l’environnement se propose (...) d’intégrer la politique de l’environnement dans le développement global du pays. »

<sup>3</sup> Nos missions correspondent aux résultats attendus en fin de programmes (...)

- Mettre en place une structure pérenne de protection et de cohabitation saine entre la population et son environnement,
- *Dégager un schéma d'autogestion de l'environnement par les populations* (author’s emphasis).

Before ICDPs had a chance to show conservation/livelihood positive results (Uphoff and Buck n.d.), a new breed of projects surfaced to address increasing criticism to the effect that protected areas, of which ICDPs were part, failed to reflect the existence of ecological zones, or eco-regions. This new approach called for the inclusion of “corridors” linking natural habitats into units of conservation. This approach has been operationalized since the late 1990s.

### **The Place of Institutions**

In the flurry of theoretical debates and project development, little attention was given to institutional factors affecting forest use and management at the community level. This is not to suggest that institutions were ignored, but the focus remained on the national level. To be fair, conservation organizations began to incorporate institutional elements in their mission statements, probably to reflect the government’s push for decentralization of natural resource management in 1996 (GOM Loi N° 96-025). Increasingly, international and Malagasy NGOs, foreign donors, as well as the Malagasy government itself, began to incorporate “local communities’ participation” and “institution building” into their conservation approach, a trend illustrated by the following Malagasy NGO’s “conservation philosophy” statement:

#### **Conservation Philosophy**

The pervasive degradation of natural resources in Madagascar has led FANAMBY to focus on improving the way resources are managed. FANAMBY aims to develop local competence in sustainable resources management in its intervention areas. *Our conservation philosophy focuses on two objectives; one, building human resources capable of managing and protecting natural resources; and two, teaching rural populations the laws governing their natural resources.* We have developed over the last 5 years a replicable conservation model, which is based on the creation of legally protected areas within the framework of a regional management plan. In compliance with the decentralization policy of Madagascar, these actions aim to empower managers at the local level and involve them in all initiatives from designing conservation and development programs to implementing them. (Fanamby 2003, author’s emphasis).

In spite of conservation players’ honorable intentions, the scope of institutional goals remained limited, as “institutions” were persistently understood to mean government agencies such as *Eaux et Forêts* (E&F) and, sometimes, state regulations or laws about forest resources. In order to overcome institutional obstacles, therefore, it was necessary to support Malagasy state agencies involved with resource management (E&F; *Domaines*; FTM; FOFIFA, etc.) and even to create new ones (COMODE, ANGAP and ONE).

Improvements in biodiversity protection and rural livelihood hardly seem commensurate with the “institutional support” that Madagascar has received since the 1990s. At best, a great deal of confusion has resulted from increasing the number of agencies and actors in charge of conservation and development. Indeed, and to cite a E&F agent who expressed his opinion frankly in 1999, “So many people are now in charge [of conservation] that I do not see how anyone can blame us [E&F] for not

doing our job right.” As for improvements in rural livelihood, they have yet to materialize (Zeller et al. 2000; Paternostro et al. 2001).

## **Defining Institutions**

To be meaningful for conservation, institutions need to be defined not solely as organizations, but also as “complexes of norms and behaviors that persist over time by serving collectively valued purposes” (Uphoff 1986, 9). Institutions, thus, define standards of behavior, as do rules (and norms), which are statements that define what is forbidden (proscriptions), what is permissible (permissions), and what is obligatory (prescriptions). To be complete, rules must also specify what sanctions (...or else) are reserved in case of non-compliance (Crawford and Ostrom 1995). This is the definition that I adopt in order to examine the impact of rules on forest users’ behavior and make the case that overlooking this part of the causality has contributed to environmental degradation, biodiversity loss and modest, if any, improvements in rural livelihood in Madagascar.

To be sure, rules are not static. They are, rather, the result of dynamic interactions (collaboration, competition and, sometimes, mutual ignorance) among actors who find it in their interest to exploit, overexploit, or conserve forests. Fundamentally, as institutionalists argue, rules provide incentives that influence users’ cost and benefit analyses when it comes to deciding whether to conserve or exploit forest resources (Thomson 1992; North 1990).

## **Arguing for Communities’ Institutional Capital**

The question that this paper addresses is: How have rules governing the use and conservation of forest resources affected biodiversity conservation and rural people’s ability to feed themselves? I argue that the lack of attention paid to the rules affecting how resource users exploit and manage the forests on which their livelihood depends has been detrimental to devising sound policies aimed at securing rural populations’ livelihood as well as biodiversity conservation. Looking at how state and community rules are implemented at the community level in each of the four scenarios, I suggest that conservation strategies, to be successful, must find ways to integrate local communities’ institutional capital *as points of departure*. To appreciate the complexity of the deforestation problem, one must look for which institutional elements merge with demographic and economic factors. This claim is relevant to the cases examined in this analysis and, in all likelihood, to other parts of the world where issues of environmental and socio-economic degradation need to be addressed.

## **METHODS**

I draw from a pool of five rural communities located in the periphery of four forests that enjoy legal protection status (including protected areas) as well as forests whose survival has depended on local communities’ management strategies (Table 1). I organize my four cases according to the criteria of Biodiversity/Rural Livelihoods gains vs. losses, which are specified in greater detail in the individual case presentations. Keeping in mind variations in ecological conditions and production systems, the cases are of forest-dependent communities located in eastern and

southern Madagascar (Figure 1). For each case, I draw inferences that seek to illuminate how “lose” scenarios come about and how they might be avoided.

**Table 1. Biodiversity and rural livelihoods matrix**

Biodiversity	Win	Lose
Rural Livelihood		
Win	ICDPs (ideally) Analavelona Sacred Forest (South)	Zahamena National Park (East) ?
Lose	Zombitse National Park (South) ?	Ihera Classified Forest (South)

Note: The arrows indicate that, at the current rate of forest exploitation and over time, Zahamena and Zombitse run the risk of slipping into the Lose, Lose category.

A cautionary note on the data presented here is in order. For the three southern cases, namely Analavelona, Zombitse and Ihera, data were collected in 1998-1999 during my doctoral research, which explores how forest users decide to comply with or break rules about the forest. In this research, I used a household survey questionnaire to collect data on markets and administrative centers; livelihoods and forest dependence; local governance (community vs. administrative); and rules on forest products and rule compliance. I also relied on key informant and focus-group interviews and used rapid appraisal tools to complement survey data.<sup>4</sup>

The same tools were used in eastern Madagascar, but the research for this area was on the topic of existence and effectiveness of local governance in natural resource management at the community level. This research was conducted in 1993 (with a follow up study in 1995) as part of the decentralization efforts in which the GOM engaged in the mid-1990s. In this case, an effort was specifically made to appreciate villagers’ perceptions of how the quality of their lives and the abundance of the resources that their livelihoods depended on had evolved over time. In the southern cases, such evolution was not systematically investigated, as much of the research more specifically focused on the workings of rules at the local level.

Nonetheless, for all sites, communities’ histories show that different rules (state- and community-devised) were used and manipulated in order to adapt to or resist external interventions and changes internal to communities. The economic and political dynamics that resulted from the various interventions gave rise to rules-in-use that, as argued here, were partly responsible for producing resource-degrading and resource-conserving behaviors.

I use changes in forest cover (in all cases) and in species composition (in the case of Ihera forest) as a proxy for compliance/non-compliance, given the obvious difficulty

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<sup>4</sup> Respectively, 36, 30/30 and 44 individuals were surveyed in Mitia, Andranoheza/Fanjakana and Andranomaitso.

of getting people to admit that they are rule-breakers.<sup>5</sup> To assess changes in forest cover over time, satellite images are visually interpreted, using three time periods for the southern sites (Table 3) and two for the eastern site (Table 4). The time periods used for Ambodivoahangy are different because cloud-free satellite images are hard to come by for the Zahamena rainforest.<sup>6</sup>

### **General Background Information on Sites**

The three tables below succinctly present information about communities that is pertinent to this analysis. Table 2 shows that, for each of the four forests, the number of households considered falls within the 110-150 range; that the average household size is roughly constant at about 5 people; that two of the forests, Zahamena and Analavelona, are isolated from market forces, while the other two are relatively accessible. As appears in the discussion of each case, all communities are heavily dependent on agricultural activities for their livelihoods (Appendix A).

Tables 3 and 4 present deforestation data for each of the forests.<sup>7</sup> The most severe cases of change from forest to non-forest are in Zombitse and Zahamena. For Ihera, the changes were quite modest. For Analavelona the changes are so negligible that they could not be detected through visual comparison.

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<sup>5</sup> Out of 170 individuals surveyed in the south, 17 percent admitted to breaking rules. The comments that accompanied these confessions were valuable information that would have been difficult to obtain without asking informants directly about their compliance record.

<sup>6</sup> I gratefully acknowledge Ned Horning's help for the spatial analysis.

<sup>7</sup> It is important to note that the statistics are not for the whole forest but, rather, for the area surrounding the communities discussed in the analysis.

**Table 2. Community facts**

Community (Time of Investigation)	Forest	# HH	HH Av. Size	Time to Market	Time to Forest (walk)	Livelihood Choices
Ambodivoahangy (1993)	Zahamena National Park (east)	113	5.3	1 to 2 days	2 hours	1. Tavy Rice Culture 2. Poultry 3. Weaving
Andranoheza (1999)	Analavelona Sacred Forest (south)	76	5.1	2.5 hours	3.5 hours	Paddy Rice Culture Supplementary crops Poultry Cattle raising
Fanjakana (1999)		52	4.8	12.3 hours	1 hour	Paddy Rice Culture Other crops Poultry Cattle raising
Mitia (1999)	Ihera Classified Forest (south)	111	4.7	3 hours	< 1 hour	Paddy rice culture Other crops Poultry Cattle
Andranomaitso (1999)	Zombitse National Park (south)	148	5.5	2 hours	20 minutes	Hatsaka maize Poultry Sapphire mining Cattle raising

Note: HH = household.

**Table 3. Extent of deforestation around Southern forests**

Deforestation (Forest to Non-Forest Cover)				
Forest	1989-1994		1994-2000	
	Percent	Hectares	Percent	Hectares
Analavelona	None detectable	None detectable	None detectable	None detectable
Ihera	.13	4	.07	2
Zombitse	24	1,646	9	489

**Table 4. Extent of deforestation around Ambodivoahangy, Zahamena**

Deforestation (Forest to Non-Forest Cover)		
Forest	1993-2000	
	Percent	Hectares
Zahamena Enclave	3	183

## HOW RULES AFFECT NATURE CONSERVATION AND RURAL

### LIVELIHOODS

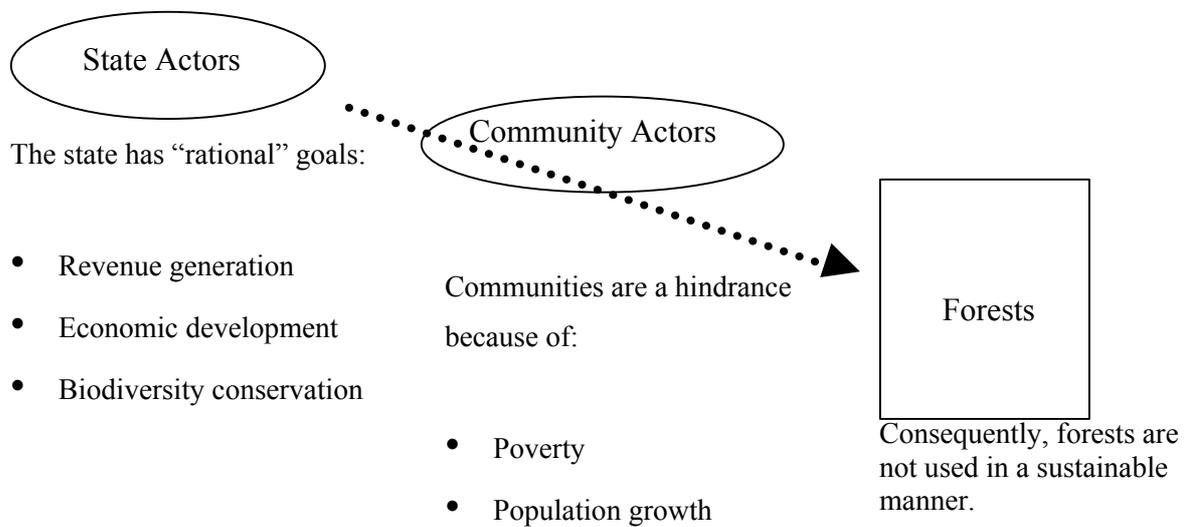
In examining cases for each of the four scenarios laid out in Table 1, our purpose should be to understand how rules--as they are implemented at the level of communities (of resource users)--affect outcomes in ways that are supportive or detrimental to biodiversity conservation and rural livelihoods on a long-term basis. What the cases presented below show is that one cannot begin to imagine conservation without community will and commitment to devising and implementing conservation rules to protect forest resources. This intuitive, if not evident, *sine qua non* is all too often misunderstood, if not overlooked.

### Crucial Relationships: Farmers, the State and Forests

Since Andrianampoinimerina united the kingdoms of Madagascar in the late 1700s, the state has presented itself as a fierce guardian of the forests (Harper 2002). To this day, all forests are considered the sole property of the state (*domaine de l'Etat*), which means that the state is the ultimate sovereign in deciding how best to exploit them. As the ultimate guarantor of sustainable forest management, the state has long exercised tremendous power over forest users, ranging from forest-dependent communities to *exploitants forestiers*. Using cumbersome, complicated legal procedures, the Malagasy state, it is fair to say, has favored the latter, often to the detriment of the former.

From the standpoint of the state, farmers have threatened the nation's interests with their "irrational" exploitation of natural resources, whereas *exploitants forestiers* have been critical instruments of economic development. Diagram A illustrates how the Malagasy state has long depicted Malagasy farmers as getting in the way of rational, sustainable forest exploitation.

### Diagram A. How the Malagasy State portrays forest-dependent farmers



Demonizing farmers’ agricultural practices has resulted in, and in some ways, justified repressive behavior on the part of the state from the days of the monarchy to the present (Jarosz 1996). There is little doubt that the practice of slash-and-burn agriculture, coupled with increasing demographic pressures in rural areas, has come at the expense of forest and, therefore, biodiversity conservation. What is questionable here is the validity of explanations for deforestation that do not pay due attention to the ways in which rules regulating the use of the eastern rainforests have affected resource conservation. To better understand the extent of the problem, one needs to shift the locus of causality away from mere social and economic problems afflicting farmers to institutional and historical ones.

Protected areas have represented the most visible attempt at keeping farmers out of forests. Their protection is governed by forest legislation that was enacted when they were established in the early 1930s, i.e., during colonial times. So long as the colonial state was willing and able to enforce its own laws, forest legislation was effective in terrifying farmers into compliance.<sup>8</sup> Upon independence, in 1960, the Malagasy state preserved the system of protected areas that the French had developed, as well as the forestry legislation that governed their protection. A drastic change came about, however, when the state espoused Marxist-Leninist ideals upon launching a socialist revolution in late 1975. To reflect collectivist ideologies, the state proclaimed that all resources were to be the property of the masses, for which slogans were blasted on the radio, quickly reaching rural areas. Farmers wasted no time exercising their newly acquired “rights” to take possession of land, sometimes by clearing forests. This was

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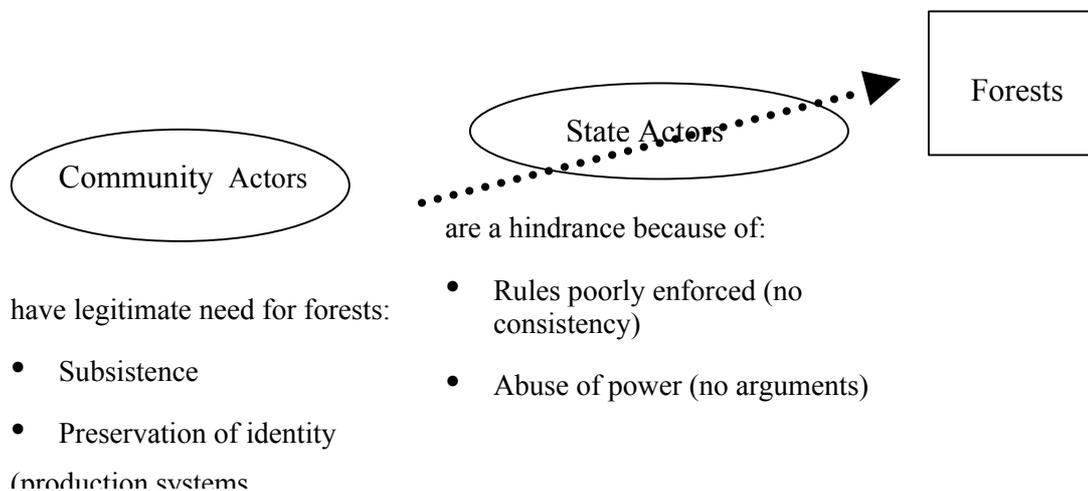
<sup>8</sup> One of the notions that farmers do not seem to share with the state (and its conservation partners) is that biodiversity is not negotiable: once lost, it does not just reappear. Yet the link between habitat destruction and species extinction is real.

an environmental disaster at the national scale. Protected areas, however, were maintained.

It was in the context of this rush for natural resources that the severely impoverished Malagasy state exposed its environmental deeds to the international donor community at the start of the liberalization phase of the mid-1980s. It was not long till foreigners praised the value of the island's biodiversity and that farmers were identified as the main culprits behind deforestation. Once again, the state assumed the role of ultimate guardian of Madagascar's forests.

Partly because of the state's renewed attempts at excluding farmers from forest exploitation, many farmers have come to perceive it as a hindrance to their livelihood security. Diagram B shows how farmers' perceptions are reversed from those of the state. Policy inconsistencies, as well as arbitrary and erratic rule enforcement on the part of the state continue to compound the problem of negative perceptions. Especially around protected areas, farmers feel that their claims to the forests are legitimate, based on their cultural heritage and the production systems that they have maintained for decades, if not centuries. Few words could faithfully describe how poorly state representatives, ranging from forest agents to judges in provincial courts, have treated *tavy* (and other, as a matter of fact) farmers. To be sure, and in the eyes of farmers, *exploitants forestiers* have been granted cutting permits in forests that farmers could not even touch, not matter how badly they needed them.

**Diagram B. How rural communities perceive the problem of deforestation**



One of the original goals of protected areas was to preserve the uniqueness of the island's most unique natural habitats, mainly for research.<sup>9</sup> The scientific purpose of protected forests is one that many rural Malagasy have learned to doubt or ignore. Instead, many farmers suspect that some underground wealth is hidden in those protected areas. The relatively recent discovery of sapphires and other precious gems

<sup>9</sup> *Réserves Naturelles Intégrales* (RNI), for instance, were to be penetrated by researchers only.

along forest tracts extending from the north (Amber Mountain and Akarana) to the south (Zombitse and Vohibasia), some running through protected areas, has done little to erase such suspicions. Since the sapphire explosion of the 1990s, even the Malagasy state's political will to defend the island's protected areas has been put to the test because of the income opportunities such non-renewable resources afford. It was not long after sapphires were discovered in the south that private business people were granted mining permits inside protected areas.

### **Win, Win Scenarios: Utopian Goal?**

To the extent that livelihood improvement and environmental protection are assumed to go hand-in-hand, win, win (WW) scenarios are feasible. This is precisely what ICDPs aim to accomplish, which leads most of its proponents to forget that forest-dependent farmers also aim for this equilibrium. By appropriating this challenging goal, policy makers have often failed, at the level of project implementation, to realize that some communities have successfully maintained this equilibrium over time in spite of multiple threats of the anthropogenic (Peluso 1992) and natural kind (L'Express de Madagascar 3/4/03).

Some community management successes point to the influential role that local institutions play in sustaining collective goods such as community forests (Agrawal and Yadama 1997). As their designation suggests, community forests provide good insights on the extent to which village forest users can successfully strike a balance between maintaining or improving their livelihoods and conserving natural habitats and the biodiversity they host.

### **CASE I: Analavelona Sacred Forest**

While WW outcomes are not so common in the real world, their rarity does not mean that they should be dismissed from inquiry. In fact, much on institutional capital can be learned from such cases. The sacred forest of Analavelona in southern Madagascar is a case in point. Located in Bara country, Analavelona is known in this area as a sacred forest (*ala masina*), which means that it hosts Bara spirits (*elo, angatsy*) who are known to demand respect from the living (Moizot 1997). Analavelona also serves practical functions for the communities that surround it. One of these communities, Andranoheza, is located southeast of the forest. Another important one, Fanjakana, is located on the western side of the sacred forest. Both communities are heavily dependent on this forest for several products (Table A, Appendix A).

Regarding people-forest relations, the fundamental Bara belief about the forest's spiritual and the material function that the forest serves has translated into well-articulated, widely known and generally well-respected rules within the communities responsible for devising and implementing them. Table 5 shows that rules exist to deal with infractions of varying gravity in Andranoheza. It is worth noting that the most severe sanctions are reserved for those who cut the largest trees.

**Table 5. Summary of rules governing the use of Analavelona forest (Eastern Side)**

Rule	Sanction
LIGHT OFFENSES	
One must not call someone by their name in the forest One must not wear gold or silver jewelry in the forest One must bring rum (toaka mena), incense (ramy) and ask for the blessing of the ancestors upon entering the forest with new visitors	... or else one will get lost from a few hours to a few days. ... or else one will lose one's jewelry (to the spirits). ... or else one will get lost and may run into a series of annoying events.
SERIOUS OFFENSES	
One must respect cleanliness, especially in sacred spots One may not introduce pork meat into the forest One must not have sexual relations in the forest <sup>10</sup> One must not cut down trees, especially large ones, in the forest	... or else serious illness, possibly leading to death, awaits one. Idem Idem ... or else serious illness, death, and curse on descendants await one.

Source: Rakotonirina 1999.

At first glance, these community rules appear to be expressed mostly in terms of prohibitions (one must not... or else) and prescriptions (one must... or else). However, a closer examination of the rules governing the access and utilization of Analavelona gives a more balanced picture in terms of proscriptions, prescriptions and permissions (Table 6). Additionally, both community and state rules apply to gallery forests surrounding the sacred forest and the sacred forest itself (i.e., the Massif). Though the Analavelona Massif has no legal “protected area” status, this forest, as any forest in Madagascar, falls under the jurisdiction of the department of *Eaux & Forêts*. Specific requirements on species and size of construction wood and wood for coffins cause users to look to Analavelona forest, where the largest trees (up to 80 cm DBH<sup>11</sup>) and valued species are found.<sup>12</sup> Because these species belong to categories (*première* and *deuxième*) protected by Madagascar’s forest legislation, state rules apply, *de jure*, to the Analavelona Massif.

<sup>10</sup> It used to be forbidden to bring women into the forest at all because of the temptation of sexual relations and also because of menstruation.

<sup>11</sup> Diameter at Breast Height.

<sup>12</sup> These species are *Dalbergia trichocarpa* locally known as *manary*; *hazo malany*, *karabo*

**Table 6. Rules pertaining to Analavelona forest, Andranoheza community (Eastern Side)**

Proscriptions	Percentage of respondents surveyed who discussed rules in detail
Killing birds inside the forest	90%
Doing “dirty” or “bad” things	60%
Taking pork, sheep and goat meat into the forest	30%
Taking women into the forest	30%
Selling products from the forest	20%
Killing animals (especially lemurs)	10% <sup>13</sup>
Permissions	
Hunting tenrecs and harvesting honey (for self-consumption only)	70%
Hunt lemurs and other animals	10%
Selling products from the forest	10%
Harvesting large trees to make coffins	10%
Prescriptions	
Observe Bara customs and rituals (rum, honey, incense, money, tobacco, zebu)	70%
Get a cutting permit from E&F prior to cutting trees inside the forest	30%
If an outsider, get permission from the fokonolona (community) prior to entering the forest	20% <sup>14</sup>

Note: One-third of surveyed people took the time to discuss rules in depth.

Community rules are thus not the only measure of institutional capital for Analavelona communities. In reality, forest legislation and community-devised rules are juxtaposed to produce what can be fairly termed exceptional conservation outcomes. Figure 2 shows that deforestation has not been a problem for Analavelona. How come? For a case such as this one the temptation is great to attribute the success of conservation to communities’ marked isolation from markets for forest products and from alternative sources of conflict resolution that presumably would weaken local institutions’ ability to effectively manage human relations, including those

<sup>13</sup> Only select families have particular taboos about lemurs.

<sup>14</sup> Community leaders tend to be more adamant about this particular prescription than other villagers.

revolving around using natural resources. Suffice it to say that the sheer effort of reaching both the sacred forest and the closest market can only discourage exploitation, let alone over-exploitation, of Analavelona. From Andranoheza, it takes about three hours, on foot, to reach both the Massif (this is a arduous hike) and the Sakaraha market. From Fanjakana, the times are less than an hour and twelve hours, respectively.

### **Resistance to External Intervention as Protection of Livelihood Strategies**

It is no coincidence that the main settlements surrounding this forest are physically isolated from the pressures of the market and of the state. The history of how these communities settled in the area and how they survived state incursions during the colonial era (1896-1960), and beyond, is testimony of some people's choice and willingness to remain in control of their governance. This is particularly evident in terms of institutional capital. To stick to rules about the sacred forest, community rules turn out to be more prescriptive and sanctions harsher than any forest legislation that these communities have ever been presented with. It is also the case that, due to difficulty of access to this area (commonly thought of as a no man's land), the forest department has had a difficult time making its presence felt and, therefore, its own laws influential. In fact, in the minds of the people of these communities, there has been no need for formal legislation because they (the communities) have been effective guards of their sacred forest.

As it turns out the sacred forest means more than the domain of the ancestors' spirits. It is the main source of fuel wood, construction lumber, medicine, honey, pasture, coffin timber and water for surrounding communities. Analavelona also serves as a hiding place for cattle on which taxes are levied if registered. Finally, this forest is notorious for being a haven for stolen cattle. To understand the motivation behind strong rules and the conservation that they have brought about, one thus needs to give zebus a privileged place between people and the forest because in Bara culture, zebus represent tradition as well as social and economic prestige: the more one owns, the more powerful one is (Elli 1993; Saint Sauveur 1998). In other words, the best protection that the Bara of Analavelona have developed against incursions into their forest is found in community rules, of which state laws are a complementary though unnecessary (at least in villagers' minds) part. Over time and against locals' fierce determination to protect their cultural identity, their livelihoods (of which the forest is such a critical instrument) the classic forces often responsible for deforestation have not prevailed.

Judging from the particular characteristics of this forest (physically isolated) and of the communities whose members interact with it (possessive and determined), this case could be labeled "exceptional," i.e., bearing little resemblance with the rest of the country. Dismissing it would be perilous, however, because these forest-dependent communities have demonstrated their capacity and willingness to manage and retain responsibility to preserve "their" forest given the great need that they have for it. They help us think about the conditions under which WW outcomes are possible. One key ingredient to WW scenarios can thus be termed "organic responsibility" for conservation. In this case, this responsibility was not given to surrounding communities. Rather, it has not successfully been taken away from them. In the meantime, the future of Analavelona rests in communities' willingness and ability to maintain livelihood strategies largely based on pastoralism.

## Win, Lose Scenarios: Farmers vs. State?

In contrast to the previous case, so-called win, lose (WL) cases, in which livelihood gains are made at the expense of forests and biodiversity, are common in Madagascar. For this reason they have caught the attention of conservation organizations and the Malagasy state, both of which have based their priorities and policies on the emergency that these cases create.

*Tavy*, a Malagasy agricultural practice that involves clearing and burning forests to make way for rice fields, is the most dramatic example of WL scenarios (Vicariot 1970). This practice is largely, though not exclusively, found in eastern Madagascar, in Betsimisaraka country, where most of the island's tropical forests are found (Faramalala 1995). As Kull (2002) has pointed out, landscape burning (in the central plateaus) has been simplistically reduced to the "fire problem" in Madagascar's political/environmental discourse. So, too, have *tavy* in the east (Jarosz 1996) and other forms of vegetation clearing such as *hatsaka* in the south (Horning 2000). So-called objective indicators have reinforced the belief that *tavy* is largely responsible for deforestation of the eastern tropical forest (Green and Sussman 1990).

### CASE II: Zahamena National Park

In Zahamena's enclave, all households practice *tavy* to grow rice. Rather than mere aggression against the forest, as is often pictured, *tavy* is actually a governance tool among *Betsimisaraka* communities (Rabesahala et al. 1994). As with any governance system, there are technical as well as political aspects to this management practice (Rabesahala and Gauthier 1995). As a technique, *tavy* reflects the *Betsimisaraka*'s efforts to adapt to their physical environment, which, just as in Analavelona, was chosen for strategic reasons. *Betsimisaraka* villages are most often located near forests and watercourses to meet villagers' domestic needs for water and fuel wood.

Given the topography of the *Betsimisaraka* landscape, seldom does one find areas where irrigated paddy rice culture is practiced. While it is conceivable that villagers perceive uphill land to remain relatively abundant and, thus, available, fundamentally, practicing *tavy* means honoring tradition, defined here as "the ways of the ancestors" (*fomban-drazana*), a notion central to *Betsimisaraka* identity. In other words, practicing *tavy* is a way of honoring one's cultural heritage as much as it one to feed one's family.

### Strain on the System

Many villagers realize that demographic pressures have come to strain their tenure systems. They base their assessment on two indicators, namely decrease in fallow period and rice yields, coupled with a marked increase in travel time from main settlement to *tavy* fields (Table D, Appendix B). This validates the theory that increases in population size do, indeed, result in agricultural expansion to the detriment of forests. The two key indicators for this are (1) a steady increase in population size neither exacerbated by in-migration nor alleviated by out-migration and (2) a net increase in (a) the distance between the main settlement and the *tavy* seasonal camps and (b) in the fallow period. That latter indicates a decrease in land fertility due to the need to cultivate the same plots in consecutive years.

While villagers appear capable of self-assessment the extent to which the state and its collaborators are also responsible for tilting the balance against forest conservation is, by contrast, not commonly acknowledged for reasons that become obvious upon examining the workings of state laws in the area over time.

### **External Interventions and Community Responses**

The idea that state repression is an integral part of the *Betsimisaraka* collective memory is important to understanding farmers' behavior vis-à-vis the forest, which brings us to yet another function that *tavy* serves: tenure security (Gage et al. 1994). The *Betsimisaraka* tenure system is one in which clearing the forest is the chosen means of appropriating land within the community. In other words, tenure is customarily established through deforestation. Every year, a council of elders (*Ray aman-dreny*) meets to discuss tenure arrangements and allocate parcels of land to individual household heads on the basis of the whole village's need for land. According to *Betsimisaraka* villagers, this system was effective so long as population pressures were under control. When that was the case, village heads routinely negotiated with state representatives to strike a compromise that accommodated state laws and community needs.

The main grievance that Ambodivoahangy residents expressed during our visits in 1993 and 1995 had to do with the state's decision to move the protected area's boundaries four times since 1951. Zahamena started off as a strict nature reserve in the 1930s. According to Malagasy forest legislation, no penetration was allowed (except for scientific research). During colonial rule, notably in the 1947 rebellion against the French colonial power, the forest became a haven for villagers eager to evade taxes and other forms of state repression. Following the free-for-all episode encouraged by the state's revolutionary impulse of 1975, Ambodivoahangy villagers "grabbed" what they could and planted jackfruit trees to mark the boundaries of their territory in 1978. Yet, in 1990, driven by a renewed desire to conserve forests, the state redrew the protected area's boundaries outward, thereby re-appropriating community land already claimed under customary law. Imagine farmers' confusion and frustration! At the eve of the 21<sup>st</sup> century, Zahamena became a National Park. While it is true that the ICDP that operated there beginning in the early 1990s did encourage improvements in terms of food storage, health practices and community woodlot management, no intervention effectively took care of villagers' sense of being cheated.

In response to the state's inconsistent behavior, Zahamana farmers have devised ways to work around state laws so as to advance their interests in expanding their agricultural fields, mostly to the detriment of the rainforest. For instance, some communities routinely agree to support the family of a farmer who turns himself in to the authority after being caught clearing and burning beyond authorized limits. This community commitment results from farmers' knowledge that the time of incarceration for such an infraction ranges from twelve to eighteen months, sometimes less, depending on the E&F agent in charge. There are also instances where communities successfully collect enough paddy rice every year in order to bribe forest agents and avoid punishment. Unlike with *exploitants forestiers*, these management strategies are not devised to profit from over exploiting the forest as much as they are to maintain communities' subsistence. In the meantime, as visual

documents show, deforested areas have expanded eastward, westward and southward for just this one community Figure 3), making it ever so harder to reach *tavy* fields.

WL situations are, therefore, not the mere result of poverty, demographic pressures and farmers' ignorance or irrationality. To understand why farmers make the decisions that they do about using the forests, one needs to pay attention to the ways in which state laws have shaped farmers' incentives, strategies, or rationalities, for securing their livelihood.

### **Lose, Lose Scenarios: What Happened to Ihera Forest?**

Lose, Lose (LL) scenarios occur when both local people and the environment lose out. Generally speaking, LL cases occur when both community and state rules fail to prevent environmental degradation that then causes production systems to deteriorate. This happens when the rates of consumption exceed resources' regeneration capacities. It not only has implications for biodiversity and rural livelihoods, but it also affects communities socially and culturally. The story of Mitia, a community located south of Ihera forest, is a case in point (Figure 1).

### **CASE III: Ihera Classified Forest**

#### **External Intervention and Community Response**

Located in Bara territory, Ihera forest used to be the forest of choice to harvest large trees to make coffins for communities of Bara relatives (*mpilongo*) settled in this area. The forest served two principal functions: like Analavelona it was a place to pasture and shelter cattle, and it served as a source of coffin lumber even for the people of Analavelona who found this forest easier to access than the sacred forest. This was the situation when the Malagasy state granted a logging company a permit to selectively harvest the most precious woods from this forest in the 1970s. From the day the loggers arrived in Ihera forest, the community of Mitia felt that the logging company operated freely and acted as an aggressor of the forest protected by state laws.

As commercially valuable woods and trees of commercial size became rare, the intensity of logging activities decreased. Nonetheless, the logging company left behind a few loggers whom local leaders manipulated to advance their economic interests: in exchange for community hospitality, community leaders expected loggers to continue harvesting lumber from Ihera so that leaders could sell the lumber and profit from illicit commercialization of tree products, thereby perpetuating, albeit at a smaller scale, the problem of illegal logging and forest depletion. This illegal lumber trade was largely encouraged by logging roads that connect the settlement to a national highway (RN7).

On the one hand, one can think of Mitia as a case in which the local community lost management control to outside pressure backed by the state. This is often the way in which the power relations between villagers and state actors are portrayed and, indeed, this is often how these relationships play out. However, this case also demonstrates that forest users will seize the opportunity to perpetuate the problem of deforestation if the social structure is such that no mechanisms are in place to prevent powerful community members from advancing their personal interests at the expense of both their peers and the environment.

### **How Mitia Community Became Worse Off, Once Logging Occurred**

In the case of Ihera, surrounding communities were worse off, not so much in terms of forest cover loss, but in terms of forest composition and, most strikingly, of loss of social cohesion. Within ten years, the trees that the communities needed to make occasional coffins were nowhere to be found in Ihera. Given the importance of burial rituals in Bara culture, this causes some psychological strain every time a person dies in the community. Most community members, i.e., those not directly related to community leaders, were also worse off because they felt that they missed out on opportunities to profit from illegally exploiting the forest. This feeling of relative deprivation caused bitterness and jealousy within the social unit. Because of the increased tensions resulting from the introduction of logging to its territory, this small community of about 100 households became administratively divided into three villages just about overnight in 1998.

As is the case among *tavy* communities, this tragedy of the commons occurred because of the state's inability and unwillingness to enforce its own conservation laws. It is precisely this institutional gap that local leaders exploited in order to adapt to new social and economic circumstances in their community. By its sheer absence, the state implicitly transferred its consent from the logging company to local leaders.

It is simplistic, therefore, to always pit farmers against the state. As is evident in this case, there are ways in which communities indirectly cooperate with state authorities to perpetuate the cycle of environmental degradation. In such cases, state institutions render local institutions powerless without necessarily succeeding in deterring resource-degrading behavior.

### **CASE IV: Zombitse National Park**

There are also ways in which key individuals from forest-dependent communities directly cooperate with state authorities to advance economic interests at the expense of biodiversity conservation and of the majority of other community members. The case of Andranomaitso community, near Zombitse National Park, is a striking example of this phenomenon. Zombitse did not acquire the status of National Park until late 1997, i.e., two-and-a-half decades after the community of Andranomaitso established itself the national highway linking Antananarivo to Fianarantsoa and Toliara (Figure 1).

According to a topographic map published in 1957, no settlements existed in or in the close proximity of Zombitse forest in 1949 (FTM 1957d). However, 1989 satellite images show that a large settlement had developed south of the forest of Zombitse and north of Hazoroa forests (Landsat TM Path 160 Row 76 April 11, 1989). This settlement is Andranomaitso. Not only had this settlement appeared suddenly, but large tracts of the forest in its proximity also disappeared rapidly. The same visual documents reveal that between 1949 and 1993, some 1,800 hectares of forests were cleared, leaving a big hole in the middle of the northern portion of Zombitse forest (Figure 4). Numerous testimonies indicate that rates of deforestation peaked around 1991. Eventually, clearing tapered off, though deforestation had yet to be controlled in 2000. According to the most recent set of satellite images publicly available, deforestation around Zombitse continued, albeit at a reduced rate of approximately 9%, between 1994 and 2000 (Landsat 2000).

## Community as Agent of Change?

Andranomaitso started off as a zebu camp in 1973, with four huts located inside the forest just north of RN7. Eight Bara herders from Sakaraha occupied this territory and pastured their cattle there. Less than two years later, E&F granted an influential Antandroy politician from Toliara a permit to harvest in the northern section of Zombitse. This logging project, *Coopérative AVOTRA*, operated from 1974 to 1980. It brought migrant loggers and relatives of various ethnic origins to Andranomaitso during a period that stretched from 1976 to 1989. In 1985, the national highway-paving project brought another wave of migrant workers to Andranomaitso. More ethnic groups became represented in the settlement.

A final wave of migrants came to settle in Andranomaitso as the result of two phenomena. First, migrants left behind by the logging company and the road project began to practice *hatsaka*, or slash-and-burn maize culture, first away from Andranomaitso and then progressively closer to the settlement and, eventually, into Zombitse forest. They were successful at producing abundant maize, a lucrative crop in the area. Since their fields were visible from the main road, passers-by could easily appreciate their prosperity, which had the effect of encouraging in-migration. Second, the period between 1990 and 1993 was a time of drought and food shortages in southern Madagascar. A place like Andranomaitso, which was increasingly known for its agricultural potentials, became a point of attraction, especially since it was accessible and since various ethnic groups were already represented there. As more and more migrants settled in Andranomaitso, the original Bara occupants were progressively forced to move south of RN7. Eventually, they retreated to Sakaraha. To some, this withdrawal symbolizes the victory of migrant agriculturalists over Bara pastoralists on Bara territory.

With a swelling number of people practicing *hatsaka*, the village fell victim to uncontrolled fires that caused major damage, first in 1988, then in 1993 (some 80 houses burned down), and finally in 1998 (30 houses burned down).<sup>15</sup> By 1991, rates of deforestation caused by *hatsaka* were so high that the state took measures to control the damage. One such measure was to replace the existing *Chef de Cantonnement* with a young E&F agent with the reputation of a “tough guy.” With his arrival appeared the notorious *dinan’ny mpanao hatsaka*, an agreement binding concerned parties to contain deforestation caused by *hatsaka*.

Faced with an increasing number of agriculturalists, local Bara pastoralists, led by two prominent *mpanarivo* (the Bara term for owners of a large number of zebras), took the initiative to curb the problem in two ways. One *mpanarivo* followed legal channels, going through the various echelons of decision-making, to file complaints and draw the attention of state authorities to the fact that his (and others’) pasture was going up in flames. The other one took matters into his own hands and sabotaged crops by letting his zebras pasture in farmers’ fields at night. These local initiatives did not

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<sup>15</sup> This is one version of the story. Some suspect that angry and frustrated Bara pastoralists may have set the fires, which is plausible.

bring any change, as *hatsaka* persisted and tensions grew dangerously in the community (Koto 1996).

### State Response

Partly in reaction to weak local initiatives, E&F attempted to join forces with Bara herders in 1991 by instituting a *dina* and by involving the community in drafting it. In its first form, the *dina* spelled out the following: “It is strictly forbidden to clear new parcels [of forest]. Or else, rule-breakers will have to abandon their land to the state and their crops to the community. In addition, they will be fined.” Although this initiative was promising, the results turned out to be disappointing, as enforcement was weak.

In 1994, World Wide Fund for Nature (WWF) came to the area to manage the complex of Zombitse and Vohibasia forests for ANGAP, the national protected areas agency. One of the first actions that WWF took was to reinforce E&F’s initiative and update the 1991 *dina*. In some ways, the 1994 *dina* was a mere reminder that a *dina* applied, but what distinguishes the second from the first version is the inclusion of community-based monitors. To show good faith and flexibility, the state exceptionally granted rule-breakers permission to keep their crops that season, but it also ordered them to abandon their parcels for good, once the growing season was over. The fine was also increased supposedly to the point of making a difference in villagers’ behavior (according to villagers themselves). This time again, and in spite of the presence of village-based monitors, problems of enforcement made the *dina* less effective than desired.

So, in 1995, having realized that some state authorities from Sakaraha were sharecropping (and thus encouraging *hatsaka*) in Andranomaitso, WWF sought to include a wider range of Sakaraha-based authorities so as to tighten monitoring. In fact, the 1995 version of the *dina* goes along the following lines: “The *dina* is maintained, and an effort is explicitly requested for enforcing the rules (which is the responsibility of both community leaders and state authorities). Rule-breakers will be turned in so that state authorities duly sanction them. A fine will be imposed for infractions.” This time around, *hatsaka* came under better control, but the fact that WWF decided to place agents in the community of Andranomaitso to reinforce monitors’ efforts may be an indication that results remained inconclusive.

Judging from villagers’ reactions to regulations, it is clear that the DMH is a misnomer, since the rules under this *dina* deal with not just *hatsaka*, as the name suggests, but also a broader range of forest products such as firewood, charcoal, construction wood, to name just the most prominent ones. The DMH touches on so many forest uses that it is difficult for users to separate DMH from E&F regulations per se. In addition, it is also clear that the set of proscriptions embedded in the DMH is hardly a community creation: the DMH is coined community-based, but only by the state and conservation project personnel. These factors, taken together, create some sort of institutional haze that precludes effective monitoring and sanctioning. Worse yet, it opens up opportunities for key individuals from the state apparatus and the community to over-exploit Zombitse to advance their personal interests. They do so by establishing exclusive patron-client relations that exclude the vast majority of community members who, for their part, suffer from a shrinking resource base coupled with extremely limited alternatives to cutting down the forest.

## **Lose, Win Scenarios: Under What Circumstances?**

In LW cases, livelihood security is undermined by excluding local people from forests. This is often the perception in forest-dependent communities located near forests with protected area status. Recent developments in Zombitse show under what circumstances such exclusion might be effective.

As alluded to earlier, sapphires were discovered in 1998 in the Sakaraha region. It is within the context of the southern rush for sapphires that the proponents of Zombitse National Park appeared on their way to achieving LW status. With the discovery of sapphires in the region, Zombitse suddenly became spared, as the males from surrounding communities chose to try their luck mining. One villager from Andranomaitso remarked: “Ever since sapphires were discovered, people have left Zombitse alone.” Add to that what other villagers said about how deforestation slowed down when WWF agents became present in the village to monitor compliance and it becomes possible to discern the conditions under which LW scenarios develop. In other words, a combination of economic (viable economic alternatives to forest exploitation) and institutional incentives (regular monitoring) is needed to turn LW situations into WW ones. The accent should be put on the “L” here, because whatever losses villagers experience from losing access to the forest should be accompanied by gains from alternative income-generating, but not forest-dependent, activities.

Looking at a national park not included in but very relevant to this study, Kramer (1994) conducted an economic analysis of the costs and benefits of creating Andasibe NP (central-eastern Madagascar, where *tavy* is practiced). Using two distinct valuation methods, Kramer concludes that, while the cost of forgoing their access to the forest is substantial for nearby villagers, the Park also creates benefits that could be used to offset these costs.<sup>16</sup> Possibly, this could be one way to minimize the negative impact of such a LW scenario. Yet, based on research done in another park, again, not included in this study’s sample, Ranomafana NP, Ferraro (2001) argues that alternative economic opportunities conducive to rural livelihood improvements, instead of distracting farmers away from the forest, can actually increase their means of exploiting the forest.

While the threat of exacerbation is plausible, an important way to avoid this is found in institutional incentives that can deter resource-degrading behavior (Uphoff and Langholz 1998; Ostrom 1990;1997). Ostrom (1990), for instance, offers a set of eight design principles, that are crucial for the success of management institutions, one of which points to monitors’ accountability to resource “appropriators” (p. 90). Establishing National Parks without accompanying rule enforcement measures cannot increase the chances of achieving LW, much less WW outcomes. Both Zahamena and Zombitse National Parks show this.

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<sup>16</sup> The methods are Opportunity Cost and Contingent Valuation. The losses for villagers amount to \$500,000 to \$700,000 annually while the Park could bring in \$800,000 to \$2,160,000 per year to visit the Park.

## CONCLUSION

By looking at the ways in which community rules and state legislation about the forest apply at the local level, our examination of four possible livelihood/biodiversity scenarios helps us identify a few key points.

First, state laws and community rules jointly shape farmers' incentives and strategies for securing their livelihood. They can entail biodiversity conservation, but can also induce over-exploitation of forests, leading to habitat and biodiversity loss.

Second, pitting local communities against state authorities in the competition for resources can either be useful or limiting. It is useful because there are ways in which communities of forest users indirectly cooperate with state authorities to perpetuate the cycle of environmental degradation. This is what the case of Ihera forest tells us. In such cases, state institutions render local institutions powerless without necessarily succeeding in deterring resource-degrading behavior. It is limiting because, as the case of the Zombitse conservation project, there are ways in which select individuals forest-dependent communities directly cooperate with state authorities to advance economic interests at the expense of biodiversity conservation. This cooperation is done by excluding the rest of community members who end up facing a shrinking resource base, thereby experiencing increasing difficulties in securing their livelihoods. It seems ironic that the DMH, discussed above, was implemented in a village where the history of the settlement precluded a real sense of community in which a collective purpose transcends individual economic interests.

Third, rules lose their power to influence behavior if not accompanied by proper enforcement mechanisms. For this reason, the view that protected areas and the legislation that supports them are the best protection against deforestation is simplistic. Until communities are given the responsibility for managing (and even mismanaging) forest resources, neither economic nor institutional incentives will suffice to protect biodiversity single-handedly.

Fourth, because state institutions (rules/regulations/laws and actors that implement them) have created or exacerbated conditions of inequality (economic and social) within communities, it stands to reason that the state and other policy-makers need to think about ways in which farmers can tap into their institutional capital to manage the resources that have remained given the environmental, social, economic and cultural contexts that these communities know best. This will require genuine political will to learn from communities rather than to teach them management skills that they had in the first place.

Finally, based on the small sample size considered in this analysis, the most that one can say is that explanations pertaining to rules complement rather than supplant those relating to poverty and demographic pressures. Rules, in turn, are malleable: they adapt to externally or internally induced changes, which may make it difficult to fully appreciate their role in maintaining successful livelihood/conservation strategies. The cases examined in this analysis, however, help appreciate the role that rules have in determining livelihood and biodiversity conservation outcomes.

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## LIST OF ACRONYMS AND FOREIGN TERMS

ANGAP	Agence Nationale de Gestion des Aires Protégées
CIIFAD	Cornell Institute for Food and Agricultural Development
COMODE	Conseil Malgache des Organisations pour le Développement et l'Environnement
Domaines	Madagascar's Land Titling Agency
FTM	Foiben-Taosarintanin'i Madagasikara (Mapping Agency)
ICDP	Integrated Conservation and Development Project
E&F	Madagascar's Forest Service
DMH	<i>Dinan'ny Mpanao Hatsaka</i>
KASTI	Village-based E&F monitoring agents
FTM	Madagascar's Mapping Agency
GOM	Government of Madagascar
PMC	Participatory Management Clearing House
NGO	Non-Governmental Organization
ONE	Office National de l'Environnement
RNI	Réserve Naturelle Intégrale (strict nature reserve)
USAID	United States Agency for International Development
WWF	World Wide Fund for Nature or World Wildlife Fund

## APPENDIX A

**Table A. Forest Products Used by Analavelona communities**

Forest Products	Percentage of Respondents Who Cited Product <sup>17</sup>	
	Andranoheza	Fanjakana
Fuel wood	90	50
Lumber for construction	67	47
Food ( <i>tenrecs</i> , lemurs, honey)	27	43
Pasture	13	0
Lumber for coffins ( <i>tamango</i> )	0	3

**Table B. Forest Products Used by Mitia, Ihera Forest**

Forest Products	Percentage of Respondents Who Cited Product <sup>18</sup>
Fuel wood	64
Lumber for construction	44
Food ( <i>tenrecs</i> , honey)	47
Medicine	8

**Table C. Forest Products Used by Andranomaitso, Zombitse Forest<sup>19</sup>**

Forest Products	Percentage of Respondents Who Cited Product <sup>20</sup>
Fuel wood	75
Lumber for construction	48
Food ( <i>tenrecs</i> , honey)	25
Medicine	7
<i>Hatsaka</i> (land)	2
Lumber for coffin Tamango	2

<sup>17</sup> Thirty informants (half of whom were women, the other half men) responded to our survey.

<sup>18</sup> Thirty-six informants (half women, half men) responded to the survey.

<sup>19</sup> It is important to note that answers were limited to legal uses of the forest. Illegal uses include charcoal and fuel wood commercialization and lumber.

<sup>20</sup> Forty-four informants (21 women, 23 men) responded to the survey.

**Table D. Changes in Key Indicators in Zahamena Enclave (1940-1993)**

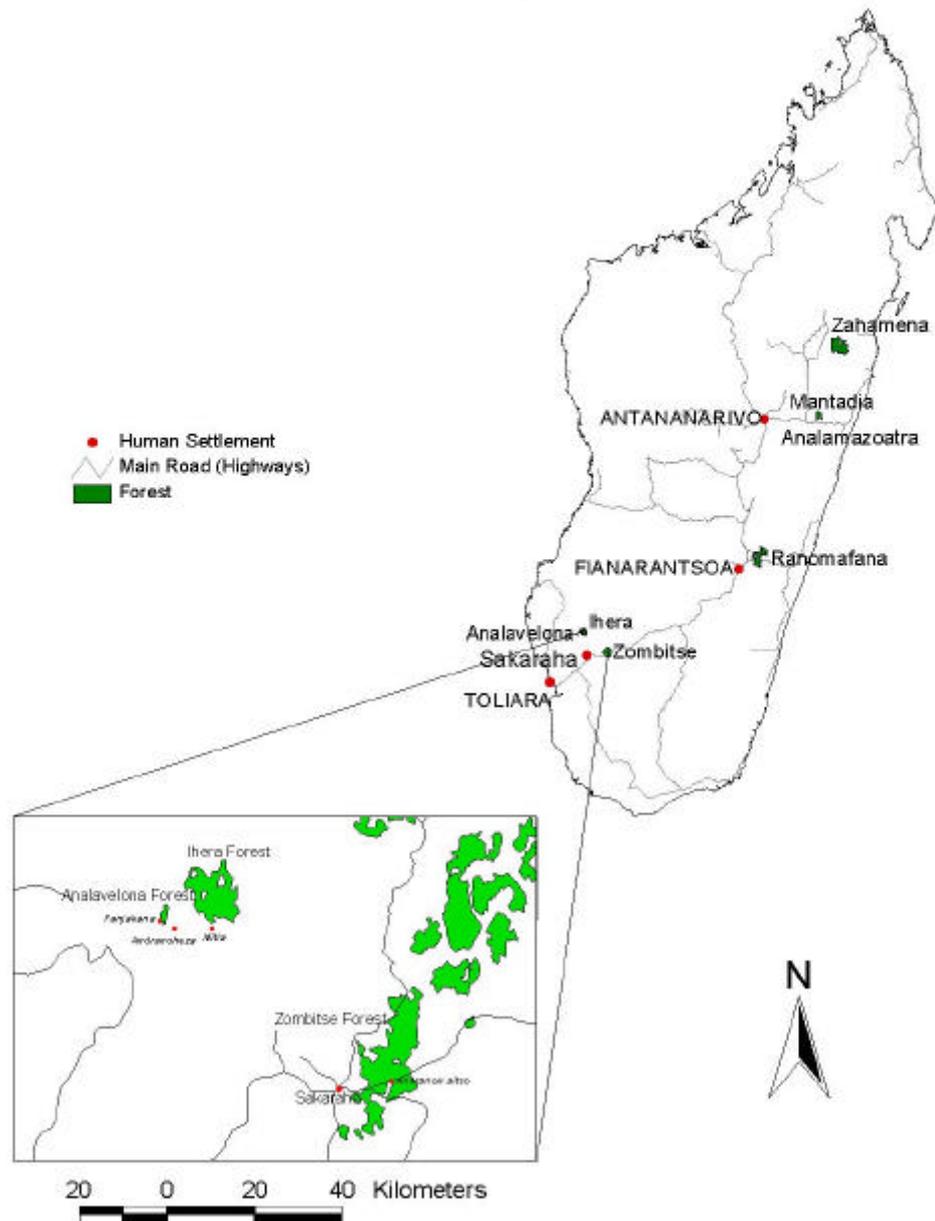
Variable	1940	1956	1967	1981-1993
Population Size	1	3	6	10
Number of Immigrants	0	0	0	1
Number of Conflicts (within community)	0	1	2	4
Cultivable Areas	10	8	6	3
Distance Village-Tavy fields	1	1	4	6
Agricultural Production	6	6	10	4
Fallow Period	2	3	3	8
Cost of Living	3	4	5	10

*Note:* Using rapid appraisal tools, villagers were asked to “quantify” variables using a scale of 0 for lowest to 10 for most

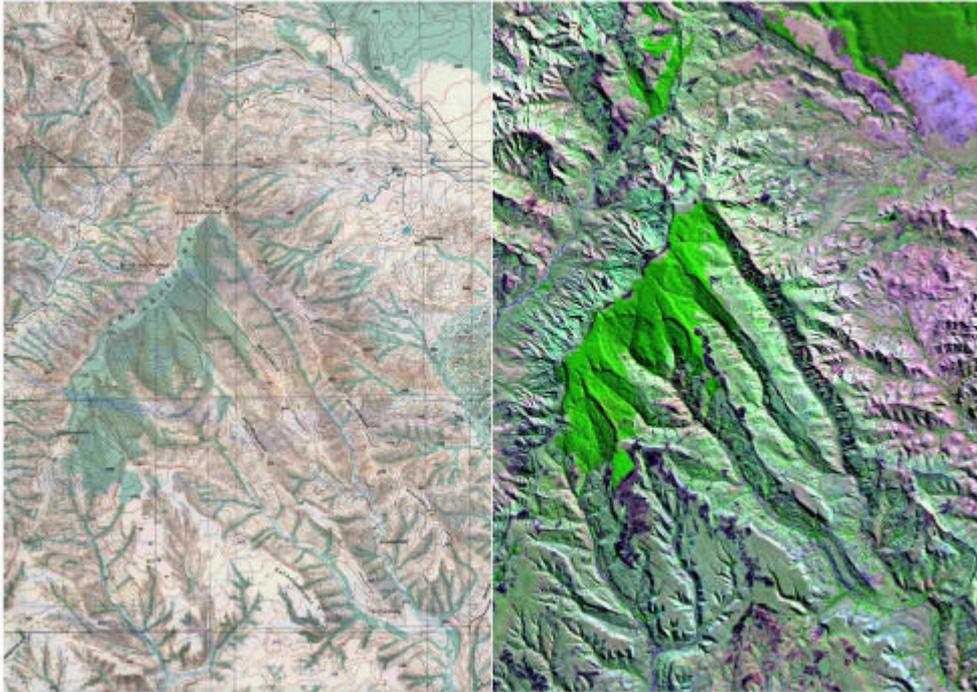
## APPENDIX B

Figure 1. Map of protected areas cited and study sites in Southern Madagascar

### Map 1



**Figure 2. Evolution of Analavelona forest cover from 1949 (left) to 1993 (right)**



**Figure 3. Evolution of Forest Cover in Zahamena Enclave from 1949 (left) to 2000 (right)**

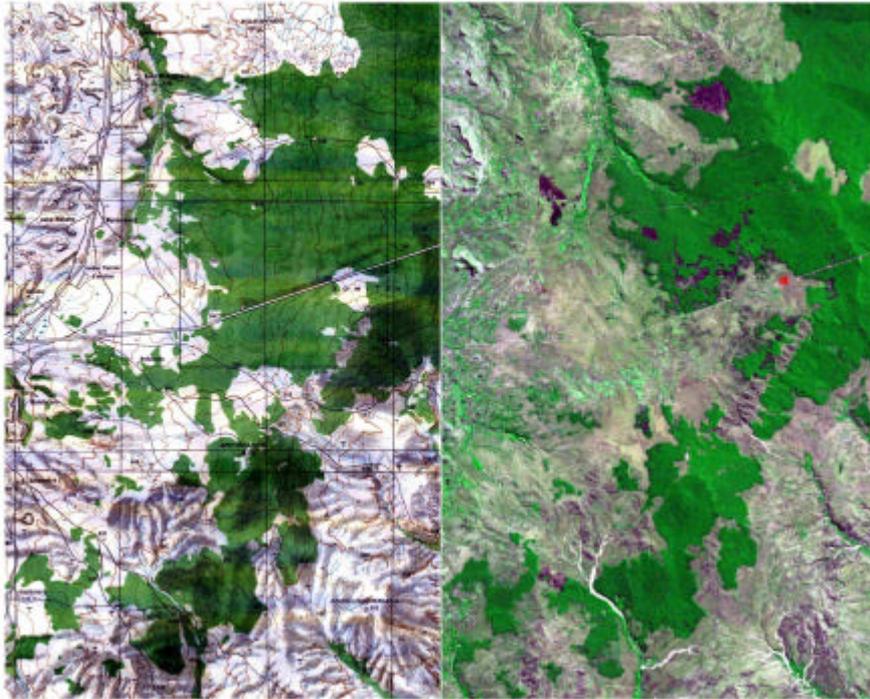


Figure 4. Evolution of forest cover in Zombitse from 1949 (left) to 1993 (right)

