Agriculture in Madagascar: Conservation and Cultural Meanings of Rice

Douglas William Hume, Ph.D.

University of Connecticut, 2005

This dissertation examines the cultural meanings of rice agriculture in Madagascar and their implications for conservation projects. It discusses Madagascar's prehistory and history of the Malagasy people's relationship with their environment and literature on the theory and application of cultural models. It compares the positions and priorities of Malagasy governmental and non-governmental stakeholders to show the potential conflicts between the goals of agricultural development and conservation organizations and those of the local farmers. It describes and compares the categorization of rice varieties according to rice merchants and rural farmers. Finally, it evaluates the influence of conservation organizations on the cultural model of *tavy* (swidden agriculture) in eastern Madagascar by testing and confirming the following hypothesis: as knowledge of non-indigenous conservation practices increases, knowledge of *tavy* rituals decreases. Thus, farmers in protected areas are more influence by the introduction of non-indigenous conservation practices than those living in unprotected areas. This dissertation concludes with a discussion of the future prospects of rice agriculture, conservation and the rural farmers, who will be the ones most affected by change.

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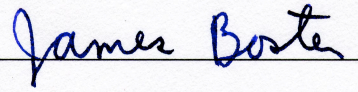
Major Advisor 

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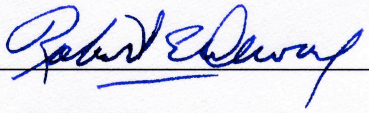
Associate Advisor 

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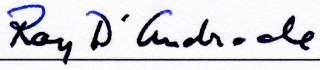
Associate Advisor 

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List of Figures and Tables

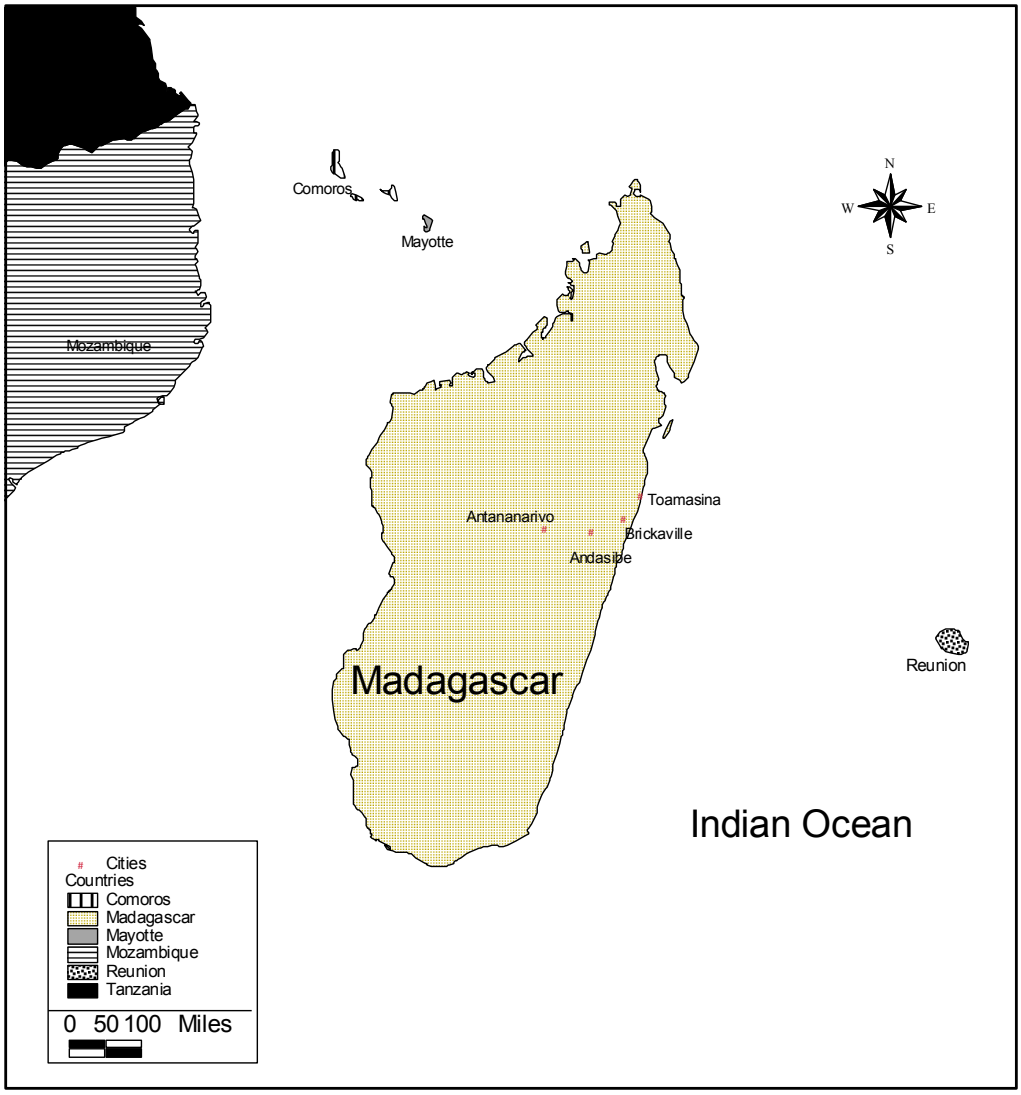
Glossary of Frequently Cited Words

Andriamanitra	God
betsabetsa	fermented beer from rice and honey
fady	taboo
fanafody	Malagasy medicine (performed by *mpanandro*)
fotsy	white
Gasy	Malagasy (shortened version usually limited to compound words)
masomboly	seed reserved to be sown
mena	red
mpanandro	healer and diviner
ravinala	travelers palm (*Ravinala madagascariensis*)
razana	ancestors
siramamy	sugar
stok	old rice (imported or local)
tangalamena	elder who ensures people properly adhere to the customs
tanimbary	irrigated rice field (marshes and terrace)
tantely	honey
tavy	swidden agriculture as practiced by the Malagasy
toaka-Gasy	distilled rum made with sugar cane
vary	rice
vazimba	natural spirits from *Andriamanitra*, less powerful than *zanahary*
zanahary	natural spirits from *Andriamanitra*, more powerful than *vazimba*

Glossary of Frequently Cited Acronyms

ADRA	Adventist Development and Relief Agency International
ANGAP	L'Association Nationale pour la Gestion des Aires Protégées, Toamasina and Parc National D'Andasibe
CBC	Community-based Conservation
EASTA	Ecole d'Application des Sciences et Techniques Agricole, Analamalotra, Toamasina
FMg	Malagasy Francs (6,250 FMg was equal to one United States Dollar in May 2003)
FOFIFA	Ministère de la Recherche Scientifique, Direction Inter Regionale Centre, Régional de Recherche Est, FOFIFA, Toamasina
IRRI	International Rice Research Institute
MAE	Ministère de l'Agriculture et de l'Elevage, Direction Inter Regionale du Développement Rural, Toamasina
MEF	Ministère des Eaux et Forêts, Toamasina
NAT	Association Mitsinjo, Stiftung Natur und Artenschutz in Den Toten
SAF-FJKM	Sampan'Asa momba ny Fampandrosoana - Fiangonan'i Jesoa Kristy Eto Madagasikara
USAID	United States Agency for International Development
WWF	World Wildlife Fund

Map of Madagascar



Chapter 1. Introduction

This dissertation examines the cultural meanings of agriculture in Madagascar and their implications for conservation projects by presenting the analysis of ethnographic data concerning conservation and cultural meanings of rice. Chapter 2 provides the background to the impact of cultural beliefs in the attempt to solve the agricultural crisis in Madagascar. The crisis in eastern Madagascar is the result of high human population levels and limited available fertile farmland that has resulted in shortened fallow periods (in some cases as short as two years), which in turn decreases the fertility of the soil, hastens topsoil erosion and reduces local biodiversity (Sorg et al. 2000). There has been a degradation of the local environment and the local population is having increasing difficulty being able to grow sufficient food to support itself. To solve, or at least mitigate this crisis, the Malagasy government is implementing several agricultural and social policies designed to promote biodiversity conservation. The government is also attempting to increase crop yields to meet the needs of the rising human population. Since rice is the staple of the Malagasy diet and is consumed in greater quantities per capita than any other nation[1] (IRRI 2004), increasing crop yields is an important development goal for the country as a whole. One key aspect of this planned agricultural change that has been neglected by the Malagasy government and non-governmental organizations is the impact this change will have on the rural farmer's belief system concerning their traditional agriculture.

Chapter 3 describes the historical background of the problem of rice agriculture and conservation in Madagascar, discussing the prehistory and history of the Malagasy people's relationship with their environment. From the anthropogenic causes of mass

[1] Consumption has decreased from 150 kg/year in 1977 to 118 kg/year in 1995.

extinction in Madagascar approximately 500 to 1,500 years ago to the current political crises, the relationship between the Malagasy people and their environment is a complex one, with both ecological and political aspects. This chapter concludes with a discussion of the current anthropological research on conservation practices by the local people of natural resources in Madagascar.

Chapter 4 traces the development of cultural models in cognitive anthropology, beginning with a review of relevant literature of schemas, which are the basic building blocks of cultural models. This review is followed by an examination of the current understandings and analytic uses of cultural models in anthropology. This chapter concludes with a summary of cultural models as used in this analysis.

Chapter 5 describes the methods of ethnographic data collection and analysis in this research. The ethnographic data for this dissertation was collected during July 2001, January through July 2003 and May through July 2004 in the eastern Madagascar town of Toamasina, Brickaville and Andasibe. Ethnographic samples consisted of over 300 informants from these areas (approximately 70 in Toamasina, 30 in Brickaville and 200 Andasibe). The methods of data collection included open-ended semi-structured interviews, fixed-form survey instruments and both successive and simple pile sorting.

Chapter 6 describes and compares the categorization of rice among rice merchants in Toamasina and rural farmers in Andasibe. The basic focus of the merchant's rice categorization is the appearance of the grain, whereas the farmer's categorization is on the rice plant's characteristics.

Chapter 7 analyzes agricultural rituals and examines the hypothesis that as knowledge of non-indigenous conservation practices increases, knowledge of *tavy*

(swidden agriculture as termed by the Malagasy) decreases. To understand the influence of conservation organizations, there is a comparison of communities in protected and unprotected areas of eastern Madagascar, influenced in varying degrees by the introduction of non-indigenous conservation practices. The three communities examined, Andasibe, Mahatsara and Ampangalatsary, each show different levels of agricultural ritual knowledge that appear to be related to the number of conservation groups working within each community.

Chapter 8 concludes with an outlook of the future of rice agriculture and conservation in relation to the rural farmers, the ones most effected by change. A discussion of the development of agriculture in Madagascar is made by summarizing the relationships between stakeholders, knowledge of rice merchants and *tavy* ritual beliefs analyzed in this research. Finally, this chapter discusses what steps should be taken to allow agricultural and conservation development programs to have a greater chance of success.

Chapter 2. Problem

The government sponsored attempts to end swidden agriculture in eastern Madagascar have largely failed due to lack of funding and other resources. In many parts of eastern Madagascar, high human population levels and limited available fertile farmland have resulted in shortened fallow periods (in some cases as short as two years), which in turn decreases the fertility of the soil, hastens topsoil erosion and reduces local biodiversity (Sorg et al. 2000). The Malagasy government is implementing several agricultural and social policies designed to promote biodiversity conservation and increase crop yields to meet the increased needs of the rising human population (IRRI 2004). Since rice is a staple of the Malagasy diet, consumed in greater quantities per capita than any other nation, increasing crop yields is an important development goal for the country as a whole. One key aspect of planned agricultural change neglected by the Malagasy government is the impact this change will have on the rural farmer's belief system connected with their traditional agriculture, *tavy*. *Tavy* involves several rituals that appease gods, ancestors and spirits that inhabit the land. It has been suggested that, without participating in these rituals, many farmers in eastern Madagascar believe that their sense of identity as farmers will be lost (Harper 2002). The success of any agricultural development project must not only attempt to balance the economic costs and benefits for the participants involved in the change, but take into account the political, agricultural, ecological and cultural consequences of such change. As the current plan of the Malagasy government stands, only the political, agricultural, ecological and economic problems of the agricultural change are considered in policymaking; culture is being ignored.

2.1. Purpose

This research evaluates the influence of conservation organizations upon indigenous people, in particular, the organization's effect on the cultural model of *tavy* (swidden agriculture) in eastern Madagascar. By understanding the cultural significance of *tavy*, there is hope that the planned transition from *tavy* to irrigated agriculture is achievable in a culturally appropriate manner. Not only is it necessary to take into account the cultural role *tavy* plays in Madagascar before the implementation of a development program, but also to understand how the introduction of non-indigenous conservation practices has influenced ritual elements of *tavy*. Much of the anthropological focus on agricultural practices and conservation in Madagascar is on political ecology (e.g., Gezon 1997a, Gezon 1997b, Gezon 1999a, Gezon 1999b) and land use (e.g., Durbin and Ralambo 1994), but there has been less attention to the impact of conservation organizations on the indigenous Malagasy and the rituals of *tavy* (for two exceptions see Harper 2002, Razafiarivony 1995). These works have described how conservation projects affect economies and community structure, whereas the research presented here addresses the effect projects have of knowledge and ritual. The research examines Malagasy's schemas and cultural models of the ritual elements of *tavy* while others have only reported how other do *tavy*. The shared knowledge of these cultural models is the focus of this analysis.

The agricultural practices of the communities located in protected areas of primary and secondary mid-altitude rain forests are monitored by the Association Nationale pour la Gestion des Aires Protégées (ANGAP) and the agricultural practices of those located in unprotected areas of severely degraded mid-altitude rain forests are

monitored by the Ministère des Eaux et Forêts (MEF). ANGAP, which serves as a Malagasy non-governmental organization (NGO), manages protected areas while the MEF focuses on remnants of forest that are not included in the protected areas. In addition to these two Malagasy agencies, several international NGOs are promoting conservation and sustainable resource use in Madagascar (e.g., United States Agency for International Development [USAID], World Wildlife Fund [WWF] and the World Bank). Central to many of the programs of these NGOs is educating the local indigenous population on non-local techniques.

This research is the result of a collaborative effort between multiple agencies[2], including ANGAP and the MEF, to evaluate whether a transition from rice grown by swidden agricultural methods to wet terraced fields is feasible in the eastern Madagascar province of Toamasina. *Tavy* is of interest to scientists and conservation groups in Madagascar not only because of its adverse effect on the endemic flora and fauna, but also because it is both ecologically and economically unsustainable under current human population densities. Only one of the over 200 rural farmers interviewed stated that they could be self sufficient by farming alone, as their crop yields were too low due to overuse of the land. Farmers report that they may allow a field to lay fallow for only two years, instead of ten or more, because they lack enough fertile land in which to grow their crops. Several institutions and agencies are currently exploring possible methods of instituting a

[2] The following is the full list of collaborators in this research: Institut de Civilisations / Musée d'Art et d'Archéologie de l'Université d'Antananarivo; Centre d'Études et de Recherches Ethnologiques et Linguistiques, Université de Toamasina; Ministre de la Recherch Scientific, Direction Inter Regionale Centre, Regional de Recherch Est, FO. FI. FA., Toamasina; Ministre des Eaux et Forêts, Toamasina; Ecole d'Application des Sciences et Techniques Agricole (E.A.S.T.A.), Analamalotra, Toamasina; Commissaire General Charge des Relations Publiques et du Developpement Socio-Cultural; Ministre de l'Agriculture et de l'Elevage, Direction Inter Regionale du Developpement Rural Toamasina; and L'Association Nationale pour la Gestion des Aires Protégées (A.N.G.A.P.), Toamasina and Parc National D'Andasibe.

change of agricultural practices in the eastern regions of Madagascar. This transition is essential so that the Malagasy population not only has a stable source of food but also is able to maintain its environmental and economic integrity. These agencies and institutions also seek to protect the remnants of rainforest and to restore the degraded buffer areas around protected areas. The practice of swidden agriculture in these buffer zones prevents this restoration. Their goal, then, is to end the practice of swidden agriculture by providing an alternative means of agricultural production that is ecologically and economically viable for the area. The purpose of this dissertation is to document the cultural meaning of rice and the religious beliefs associated with *tavy* so that plans for agricultural development programs in eastern Madagascar can take into account farmer's belief systems.

This research is related to work by other anthropologists in three broad areas; culture modeling, non-western environmental knowledge and conservation practices of local communities. First, while there are numerous examples of research on cultural models of conservation in western cultures (e.g., Chernela 1987, Kempton, Boster, and Hartley 1995, Peña 1992), there has been relatively few studies of non-western models of conservation. Where research has been completed on non-western conservation beliefs, there has not been a focus on the pattern of sharing of the beliefs within the culture group (e.g., Brightman 1987, Callicott 1982, Ellen 1994). The analysis of intra-cultural variation allows for the assessment of the degree to which cultural knowledge is shared within a group (Boster 1985, 1987, Brewer, Romney, and Batchelder 1991, Garro 1988, 2000, Kempton, Boster, and Hartley 1995, Romney 1989, 1999, Romney, Batchelder, and Weller 1987, Romney, Weller, and Batchelder 1986, Strauss and Quinn 1997). An

interest in non-western beliefs about conservation is also evident in the literature concerning Malagasy agricultural practices, but the focus has been on political ecology (e.g., Gezon 1997a, 1997b, 1999a, 1999b), or land use (e.g., Durbin and Ralambo 1994). Current research on past land-use and conservation in eastern Madagascar (Ranaivoasy et al. 2003), analyzes the long history of human interaction with the environment that has reduced local fauna and flora by "wood gathering and lumbering for fuel-wood and construction, clearing for fields, hunting, the introduction of new species, and herding domestic stock" (Dewar 1997:373). This research will both add to the current understandings of cultural models of conservation in non-western contexts and current natural resource use in Madagascar.

2.2. Humans and Conservation in Madagascar

The effect that humans have on the environment depends on how natural resources are used. For example, recent anthropogenic degradation and fragmentation of Madagascar's forests have been interpreted as a principal cause of the decline of many endemic flora and fauna species, including lemurs (Godfrey et al. 1997) and avifauna (Langrand and Wilmé 1997). However, the magnitude of the human effect of forest clearing is dependent on human population density (Dewar 1997:373). Since human populations were low when the catastrophic extinctions occurred in Madagascar (circa 2,000 to 1,500 years ago), the cause of these extinctions are attributed to different causes than the current environmental problems in Madagascar, such as fire and climate change. The species extinction due to forest habitat loss is only a recent phenomena (Dewar 1997:373). Human exploitation of Madagascar's natural resources is occurring at an increasing rate from both local population pressure and, in recent years, an increase in

international mining interests.

Due to Madagascar's history, large size and isolation from the continent, floral and faunal populations have survived where they have not elsewhere. Due to the extent of threatened biodiversity in Madagascar, it has recently been cited as being one of the topmost biodiversity conservation concerns (Myers et al. 2000:857). An additional concern to conservation groups is that less than 10 per cent of primary forest remains in Madagascar (Du Puy and Moat 1996, Myers et al. 2000:857, Nelson and Horning 1993). Deforestation in eastern Madagascar is occurring at an estimated rate of 1.6 to 9.5 percent a year (Dufiles 2003:96). The continued loss of habitat jeopardizes the survival of a significant portion of global biodiversity, as 75 to 85 percent of the species in Madagascar are endemic, and account for approximately 3.2 percent of the global plant species and 2.8 percent of the global vertebrate species (Dransfield and Beentje 1995, Glaw and Vences 1994, Mittermeier et al. 1994, Myers et al. 2000). Local extinctions in Madagascar influence not only the local biodiversity, but global diversity as well.

Swidden agriculture is of particular concern to scientists and conservation groups in Madagascar not only because of its adverse effect on the endemic flora and fauna, but also because it is both ecologically and economically unsustainable. Several institutions are currently exploring possible methods of changing agricultural practices in the eastern regions of Madagascar. These institutions also seek to protect remnants of rainforest and hope to restore degraded buffer zones that surround protected areas. Swidden agriculture prevents this restoration. Their goal is to end swidden agriculture by providing an alternative means of agricultural production that is ecologically and economically viable. This transition is essential both for assuring that the Malagasy population has a stable

source of food and also for assuring it is able to maintain its environmental and economic integrity.

2.3. Culture and Conservation

As with other developing countries, a top-down approach in implementing a conservation program is not feasible because the governmental infrastructure needed for such a task does not exist in Madagascar. In other words, developing countries like Madagascar simply cannot afford to maintain conservation efforts. The economic resources that are needed to enforce legislation are absent. Since the possible violators are rural farmers with few resources, proceeds from fines for violating regulations cannot substantially offset enforcement costs. In place of an institutional or legislative approach, there is a growing trend towards community-based conservation in developing countries [e.g., Indonesia (Zerner 1994), Peru (Bodmer 1994) and Zimbabewe (Metcalfe 1994)], which begins with the communities involved rather than the national or other governmental agency. Yet, indigenous communities are not always successful instituting a conservation program because "traditional conservation beliefs… are not ready-made prescriptions for today's world" (Western and Wright 1994:2). The hope is that the coordination of scientific research and indigenous traditional values will lead to project success (Rabetaliana and Schachenmann 1999). It is not enough to have conservation biologists and/or ecologists involved with a conservation project, but the members of a community must be aware of the consequences of their subsistence practices on the environment (Kleymeyer 1994:323).

Conservation projects have attempted to increase awareness by reviving ancestral technologies (e.g., Cornista and Escueta 1990), calling on a traditional conservation ethic

(e.g., LaDuke 1992), or teaching contemporary conservation methods (e.g., Palmer, Sanchez, and Mayorga 1991). It is clear that the belief systems of the community involved in a conservation project must be understood before any project can begin, but in practice this step is rarely taken. Instead, ecologists, economists and other policymakers design the conservation project without understanding the belief systems of the communities involved. In most cases, there are no examinations of local cultural beliefs that would allow them to be integrated within the project.

In addition to knowledge of the value of conservation, a community involved with a conservation project must have land-tenure and economic rights to be able to succeed in conservation efforts (Lynch and Alcorn 1994, Western and Wright 1994). The communities must have control over the resource in order to restrict use of the resource (Lynch and Alcorn 1994:375). This control may either take the form of private or communal land ownership. Economic rights are necessary because communities that conserve resources without economic benefits are "virtually nonexistent" (Little 1994:350). Even in areas where state level conservation regulation is in effect, if control or resources are not available to communities, no level of enforcement is able to curb resource degradation. Therefore, any CBC program must allocate economic benefits and resource control to the participating local community for conservation efforts to succeed.

2.4. Hypothesis

Fieldwork conducted in early 2003 identified that the rituals associated with *tavy* appeared to vary inversely in proportion to the degree that rural farmers were the beneficiaries of development programs aimed at improving crop yields by the Ministère de la Recherche Scientifique, Direction Inter Regionale Centre, Régional de Recherche

Est (FOFIFA), MEF and Ministère de l'Agriculture et de l'Elevagec (MAE). Because development programs appeared to be influencing the ritual beliefs and practices of the farmers, this research attempts to test the following hypothesis: As knowledge of non-indigenous conservation practices increases, knowledge of *tavy* rituals decreases. If there has been important influence by conservation groups on local cultural practices, conservation organizations might be displacing indigenous beliefs with non-indigenous ones. This could be a sign of the success of conservation organizations in reducing agricultural practices that are no longer sustainable. If conservation groups have not influenced local cultural practices, both knowledge of non-indigenous conservation practices and *tavy* may increase. In other words, it could be that conservation organizations promote the sharing of knowledge of both non-indigenous conservation practices and *tavy* as result of educational materials comparing non-indigenous conservation practices and *tavy*. A final possibility is that there may be no correlation between shared knowledge of non-indigenous conservation practices and *tavy*.

Chapter 3. Madagascar's History of Land Use

The relationship between the people and environment of Madagascar is a growing area of research that has the unique purpose of the conservation of both the biotic natural environments and the culture of the people that inhabit them. The application of anthropological insights to the conservation of natural resources by human communities has proved a useful addition to the biological, political, and economic aspects of natural resource conservation. As an introduction to the current issues and problems in Madagascar, this chapter will first discuss the anthropogenic extinction of the megafauna in Madagascar. Next, there is a summation of the rise of the nation state followed by the period as a French colony. Discussed within this summary are the changes that occurred in the use of natural resources. Finally, there is a presentation of the independence and subsequent conservation practices within Madagascar. This chapter will conclude with a discussion of the current anthropological research on conservation practices by the local people of natural resources in Madagascar.

3.1. Madagascar's Ecosystems Prior to Human Settlement

Madagascar's unique biotic composition/assembly is due to its isolation as an island, the late arrival of humans and unique environmental configuration. Madagascar split from the African continent approximately 150-160 million years ago (Ma) and from the Indian subcontinent around 88-94.5 Ma (Krause, Hartman, and Wells 1997:10). From 88-94.5 Ma to approximately 2,000 years ago, Madagascar remained relatively isolated from the mainland. Madagascar began with the same or at least very similar inventory of floral and faunal species as the mainland. However, those species 'trapped' on the island were constrained by different environmental factors than those on the

mainland, which resulted in a distinct and unique biotic composition. Once separated, Madagascar became a continental island, but species appear to have continued to immigrate from Africa and India because of winds and water currents that enabled smaller species to be transported on debris rafts or, in the case of birds, migration (Krause, Hartman, and Wells 1997). However, the biodiversity of Madagascar remained unique since these introductions were infrequent. Madagascar's virtual isolation from continental Africa has allowed Madagascar's floral and faunal populations to evolve independently, responding to radically different evolutionary pressures than those on the mainland. Madagascar is predominantly comprised of species found nowhere else in the world and many are so radically different as to be fantastic, as the elephant bird, the pygmy hippopotamus or the giraffe beetle.

Contributing to the high biodiversity, the unique composition of topographic (mountaine to intertidal), climatic (arid to humid) and natural communities (humid evergreen forests to arid desert forests) in Madagascar provides a diversity of environments for a variety of flora and fauna (Dewar and Wright 1993:423-424). Before the human colonization of Madagascar, it was home to "at least 44 species of primates, ranging in size from 0.05 to 200 kg (Richard and Dewar 1991), 10 species of rodents, and 20 endemic insectivore species" as well as unique reptiles, insects and bird species, including large tortoises and elephant birds (Dewar and Wright 1993:424-425). In addition to these fauna, floral species evolved separately from those on the mainland and in many cases, the entire family is unique to Madagascar because the floral and faunal diversity of Madagascar during this period evolved isolated from competition from mainland species. For example, the presence of large carnivores may apply selection

pressures on their prey to conform to certain body forms (e.g., small and agile) or behaviors to avoid predation. Because Madagascar lacks any large carnivore species birds were able to grow to gigantic sizes and became flightless. This feature of Madagascar's fauna is not unique; both gigantism and dwarfism commonly evolve on islands.

What has been most puzzling in Madagascar's evolutionary history is the extinction of Madagascar's megafauna (e.g., the pygmy hippopotamus, elephant bird and giant lemur) approximately 2,000 years ago. Although a catastrophic fire event (Humbert 1927), catastrophic drought in southern Madagascar (Mahé and Saudat 1972), first-contact overkill (Martin 1984), introduction of cattle (Dewar 1984), and hypervirulent disease (MacPhee and Marx 1997) have all been blamed for the extinction of Madagascar's megafauna, it is more likely that the synergistic effect of all of them in combination: the introduction of exotic and invasive species, climatic changes and arrival of humans caused these extinctions (Burney 1997, 1999, Dewar 1997).

3.2. The French Colonial Period (1895-1960)

With Madagascar as a protectorate of France, in 1895, the Queen, Ranavalona III, maintained internal control of Madagascar while France took control over external relations (Esoavelomandroso 1985:228-229). This awkward arrangement of dual control only lasted one year. The Merina kingdom was weak from tensions due to religious differences which had been growing for years between the oligarchy and rural population (Esoavelomandroso 1985:230-231). Queen Ranavalona III lost her control due to the insurrection by other tribes and the rural population. With such civil unrest, France seized the opportunity and treated Madagascar as a colony rather than a protectorate

(Deschamps 1985:531). General Joseph Galliéni, was sent to Madagascar by the French minister of the Colonies, André Lebon, to bring order to Madagascar (Deschamps 1985:531). It was through Galliéni's influence on ministerial directives that slavery was abolished, the Merina oligarchy was removed from power, and the French began to control the uprisings of rebels among the southern tribes that were not under Merina control (Deschamps 1985:532-533).

Over the course of the following years, 1887-1905, the rest of Madagascar was pacified by the French, which was the first time Madagascar was unified under one rule (Deschamps 1985:535-6). However, insurrections continued throughout the island during the entire French colonial presence (Esoavelomandroso 1985:245-248). During the French rule, schools, roads, medical establishments, and railways were constructed (Deschamps 1985:535-536). The introduction of French settlers, Indian traders, and Asian workers along with the exportation of natural resources alienated the Malagasy by divesting them from their own resources (Esoavelomandroso 1985:240, Fremigacci 1986:393). The economy relied directly upon France for approximately 80 percent of its trade, which included gold, rubber, skins, raphia, cattle, rice and wax (Deschamps 1985:538, Fremigacci 1986:393-395). A decree in 1926 stated that all land not owned by the Malagasy was conceded to the colonial administration and resulted in the encroachment on Malagasy ancestral land for which the Malagasy held no title (Esoavelomandroso 1985:242). This decree stemmed from the French desire for control over the natural resources of Madagascar in order to send raw materials to France. The alienation of the Malagasy continued with the heavy taxes and forced production to meet the French demand for raw natural resources to supply the their military during the First

World War (Fremigacci 1986:395-396).

The beginning of the Second World War saw the inception of a new Malagasy patriotism in response to the French colonial authority's continued increase in demand for supplies to maintain France's war effort in Europe (Gow 1984:674-675). The taxation of resources to help fight a war that was not directly in their interest increased the Malagasy discontent. The strain of being a colony of France on the Malagasy people was severe, with many examples of colonial pillaging. For example, in 1944, the French colonial government forced the farmers to sell their entire rice crop at a price far below market value. Since no rice remained with the farmer for subsistence, a vital staple resource of the Malagasy people was unavailable. This monopoly allowed the colonial authorities to set an exceedingly high price on rice when it was resold to the Malagasy people to feed themselves (Gow 1984:675). After 1945, the Malagasy political movement to become autonomous slowly gained momentum. In 1947 to 1948, a rebellion in eastern Madagascar to move towards independence and as a response to stronger control by the French colonial authority was quashed in a massacre of approximately 100,000 Malagasy, most of whom were executed (Cole 2001:61). There was little progress in gaining actual power from the French colonial administration, but the success of the establishing five provinces dividing Madagascar into smaller political units decentralized the French colonial administration (Gow 1984:677).

In addition to the role that Madagascar played in the trade of natural resources directly with France and the international market, the French colonial administration took direct measures that affected Madagascar's natural environment. The French used this hard wood in France to build and rebuild its cities and within Madagascar to construct

railroads and governmental buildings. However, in later years, due to the decline in timber, reforestation programs were begun along train lines and in the highlands to provide for Malagasy construction needs (Kull 1996:54). These reforestation programs rarely used native species, but relied heavily upon imported flora that the authorities believed to be best for construction. For example, to supplement villages, many introduced trees (*Eucalyptus*, *Acacia* and *Pinus* species) were grown on both plantations and in woodlots (Kull 1996:54). These introduced species, in many cases, spread beyond the confines of the plantations and woodlots and out-competed native flora in nearby native secondary forests. This resulted in a new forest that included both native and introduced species that led to the reduced number of endemic fauna that relied upon the native flora species for food and shelter.

In spite of these events, Galliéni's influence on the colonial administration had a positive impact upon Madagascar's natural environment by bringing about the ban on the killing of lemurs and the establishment of the first nature reserves (Réserves Naturelles Intégrales) (Kull 1996:54). These reserves were strictly controlled so that only scientific access was permitted (Kull 1996:54-55). Although these reserves had a positive local impact on the forests and the resident lemur populations, the need for natural resources to support France, resulted in the destruction of many of Madagascar's relatively untouched rainforests that were still unprotected. Therefore, the amount of degradation did not decrease, but at least shifted away from the most sensitive areas. As a direct result of deforestation of the highlands and coasts of Madagascar, many Malagasy farmers had to move to marginal environments that did not have as much yield for pasture or crops. Both the removal of natural resources by the French colonial administration and

increasing population of the native Malagasy were beginning to take a serious toll on Madagascar's natural environment.

3.3. Independence and the Three Republics (1960-date)

The pressure applied by the strengthening Malagasy political parties and several rural uprisings eventually lead to the formal independence of Madagascar on June 26, 1960 (Gow 1984:679-680). After independence in 1960, Madagascar began its newly formed republic with Philibert Tsiranana as the first president. The Tsiranana administration retained many French officials and the French were also permitted to maintain their trade and other financial interests in Madagascar during the transition away from colonialism (Gow 1984:680). In addition, to retain positive relations with France, Madagascar kept the majority of their trade with France, which in turn continued investing in education and other aid, which was repatriated with profits from capital equipment (Gow 1984:680). Madagascar politically aligned itself with South Africa, West Germany, Italy, Spain, Japan, Israel, and the European Economic Community, but was wary of any relations with the United States (Gow 1984:681). The presence of French officials, traders, land owners, and military was viewed negatively by many of Tsiranana's rivals, which became problematic as he was slowly losing control of his party leadership role for this very same reason (Gow 1984:681).

In the early years of Tsiranana's leadership, five types of protected areas, differing by their allowed use, were created to supplement the 11 Réserves Naturelles Intégrales: 5 national parks (tourism and limited forest product use by local villagers only), 23 special reserves (free access, but protected from introduced species), 158 classified forests (limited forest product use), 77 reforestation and restoration zones

(watershed and erosion control), and 4 no hunting reserves (free access, no hunting) (Kull 1996:54-55). By this point, the early 1960s, several interest groups other than the Malagasy people were attempting to protect Madagascar's natural resources. These interest groups included international and Euro-American NGOs (e.g., WWF and Conservation International), universities and research organizations (e.g., Institut Français de Recherche Scientifique pour le Développement en Coopération and Paris Museum of Natural History), bilateral aid organizations (e.g., USAID and Coopération Suisse), international governmental organizations (e.g., United Nations Educational, Scientific and Cultural Organization and the World Bank), and religious organizations (e.g., the Malagasy Lutheran church) (Kull 1996:56-58). The newly formed forests were mainly supported by the monies acquired from the WWF, USAID and Coopération Suisse (Kull 1996:55).

Though the Malagasy government had established foreign ties and began making improvements to the environment, strong opposition to the Tsiranana led government culminated with the revolt in 1972 of more than 400 students and the arrival of 50,000 additional Malagasy demonstrators in Antananarivo who "demanded Tsiranana's resignation, a revision of the *Accords* with France and the removal of French troops" (Gow 1984:683). As a result of this revolt, the government was handed to Tsiranana's army commander, General Gabriel Ramanantsoa, who eventually made the changes that had been the subjects of revolt (Gow 1984:683). In addition, in a quest to secure political power within the Malagasy party structure, Ramanantsoa established relations with Arab and communist countries and sought to increase the Malagasy presence in the still highly French influenced education and reduce the French effects in other areas of the country

(Gow 1984:683). However, Ramanantsoa was unable to satisfy all of the most powerful political parties. This may have been due to the limited power that Ramanantsoa had within the government to create change in every area of remaining French influence. After several revolts by Malagasy calling for the removal of any French influence in the country, Ramanantsoa handed power to the Interior Minister and head of the Gendarmerie, Colonel Richard Ratsimandrava, who was assassinated by unknown assailants within one week of taking office (Gow 1984:684). The resulting power vacuum within the Malagasy government led to each major political party attempting to find a leader that would be acceptable enough to its rivals to keep power.

After a year, Capitaine de Fregate Didier Ratsiraka rose to power and continued the reforms of his predecessors. These reforms lead to the severing of ties with France and the increased relations with communist states, such as the Soviet Union and China (Gow 1984:684). Because of its previous instability before Ratsiraka assumed power, this Second Republic had difficulty improving the economy. In an attempt of economic stimulation, Ratsiraka saw to the socialization of agriculture and markets. For example, the private market of agricultural products was closed and replaced by a national agency to purchase and sell rice. The agency failed and agricultural trading slowed when farmers could not sell their goods. By the early 1980's, the economic crisis had become so desperate that socialist reforms were abandoned and measures were taken to acquire aid from the World Bank, which only minimally assisted the ailing Malagasy economy. In addition, public demonstrations and corruption weakened Ratsiraka's government. By the early 1990's Ratsiraka's public and political support had waned, and in 1991, he stepped down from the presidency and went into forced exile.

During Ratsiraka's presidency, Madagascar underwent several environmental reforms. With some pressure from the WWF, in 1984 Madagascar became the first African country to adopt the National Strategy for Conservation and Development (Kull 1996:61). This allowed Madagascar to request aid from various international environmental agencies to improve and protect its natural resources. A key development was the National Conference on Conservation and Development, where funding and implementation of conservation programs were discussed (Kull 1996:61). In addition to many Malagasy ministers, representatives from conservation groups attended. During the conference, it was realized that "the link between the people and the land, painfully clear in Madagascar, is a much more immediately compelling reason for conservation than the aesthetic or intrinsic values of biodiversity preservation" (Kull 1996:61). However, it was soon apparent that the natural resource protection system that had been developing in Madagascar since the initial creation of the Réserves Naturelles Intégrales by the French colonial government was not functioning (Kull 1996:62). In an attempt to rescue Madagascar's troubled conservation structure, with the assistance of the World Bank, an Environmental Action Plan was developed in 1988, which resulted in an substantial increase of conservation activities in Madagascar (Kull 1996:63).

In the following years after Ratsiraka's removal from the presidency, there was the formation of the Third Republic, which included the election of Albert Zafy, a professor from the University of Antananarivo. However, due to the long-term economic crisis, Zafy was neither able to pay-off international debts nor increase exports, which was directly linked to the public's dissatisfaction with his leadership. After Zafy's impeachment by parliament, Ratsiraka returned to power in 1996. Ratsiraka lost the

2002 presidential elections to Marc Ravalomanana, a Malagasy entrepreneur with no direct links to the university or military. After nearly six months of revolts by Ratsiraka from his coastal home base of Toamasina, Ravalomanana was recognized by the international community as the legitimate president of Madagascar and Ratsiraka again went into forced exile.

Ravalomanana, like several of the presidents before him, is attempting to reduce French influence. He has sought aid from both the United States and Switzerland and is actively attempting to gain funds for the development of Madagascar. Controversy continues to plague these efforts to solve Madagascar's social and environmental problems. For example, aid from the World Bank to determine what to do to solve Madagascar's agricultural problems pays local provincial administrator's wages on the scale of someone living in the United States, rather than Madagascar. Many Malagasy are openly expressing anger that aid money went to pay officials rather than to fund local farmers, who are hardest hit by the agricultural problems. In sum, the same problems that have plagued the political leadership of Madagascar since independence are still in effect, namely dissatisfaction with the influence of outside countries on the development of Madagascar.

Since the 1988 creation of a Malagasy Environmental Action Plan, there has been an increase in research and money spent on conservation in Madagascar. For example, the WWF grants for research and conservation programs in Madagascar has increased more that ten times between 1983 and 1993 (Kull 1996:50). However, the economic crisis in Madagascar prevents the local government from using the funds needed to continue conservation efforts. In addition, the same economic problems felt by the

government are creating difficulty for the Malagasy citizens, which, in turn, are unable to make choices that are in the interest of the environment, but rather must make economically feasible decisions. The farmers see no benefit to saving a few hectares of forest if their family must go hungry. Therefore, for the past decade, it has been international aid organizations that have maintained conservation efforts in Madagascar. For example, during the first phase of funding of the Environmental Action Plan (EP1), approximately $120 million was raised by donor institutions to fund conservation research and programs (Gezon 2000:184). It does not appear that the current economic situation in Madagascar will take a quick positive turn, so it may fall upon the international conservation groups to continue their funding of conservation projects in Madagascar for the next few decades.

3.4. Current Anthropological Research on Conservation

Anthropological research on resource conservation in general and its application to the problems faced by the Malagasy people has been a growing field since the late 1980's. This research has mostly focused on the political processes of conservation in Madagascar, at the local, national or international levels. Accentuating problems between levels of political organization, groups that live in protected areas often do not have the economic resources to allow them to conserve. The only solution, so far, has been outside funding from conservation groups (Jolly and Jolly 1984). In addition, the major threat to primary forests in Madagascar is not logging or commercial use, but small-scale farmers who exploit the land for their own use. This is because once a farmer clears forest, it does not return to secondary forest, but farmers and herders reuse the land. The result is either that the forest is permanently converted into agricultural land or

is perpetually modified through sporadic use for agriculture or herding (Jolly and Jolly 1984).

It is the practice of swidden farming and the use of fire to stimulate growth in pastures that has lead the Malagasy government and conservation organizations to discourage the use of fire. The earliest governmental control of fires occurred in 1907, when the French colonial administration banned all use of fire except for locust control and pasture renewal (Kull 1999). In 1930, a new law allowed the use of fire only with prior authorization and increased the ability of foresters and gendarmes to enforce the new rules (Kull 1999). As conserving the natural environment became a stronger concern of the Malagasy government, in 1990 the Malagasy forest service virtually stopped issuing burning permits (Kull 1999). As a result, burning still occurs, but is not discussed by farmers or herders for fear of prosecution by the authorities. Currently, the use of fire has become problematic in conservation efforts, due to the use of fire as a means for ensuring sustainable pasturelands and the strict laws preventing the use of fire in Madagascar (Kull 2002).

The following are several key aspects of the natural resource conservation problem in Madagascar: 1) local people's knowledge and practices may be in direct conflict with those proposed by a conservation plan, 2) conservation plans focus on the natural resources and not upon the needs of the local peoples, and 3) local peoples are often left out of the conservation plan construction. The problem initially resulted from the Euro-American conservation agency's attempts to promote conservation of natural resources without including local people as active participants. However, it soon became apparent that the local people could be invaluable participants in a conservation project,

yet it was difficult to negotiate conservation activities between the local people, governmental agencies and conservation organizations.

The suggested solutions of the above problems have focused on empowering the local people to control natural resource use and conservation, rather than a governmental agency, in essence, fostering community-based conservation. Since the local people have a long evolving relationship with the environment, responding to their views of a conservation plan is vital (Rabetaliana and Schachenmann 1999). In addition, the local people's knowledge and traditions must be respected in the planning and implementation of the project in order for it to succeed (Rabetaliana and Schachenmann 1999). In addition to improving the natural resources, peoples lives must also be improved, which will result in their greater involvement in a project because it is in their best interest to do so (Gezon 1997b, 2000, Richard and Dewar 2001). If a community reaps benefits from conservation activities, they will see conservation as something they cannot do without, which should result in successful conservation of natural resources (Marcus 2001).

3.5. Conclusion

The effect that humans have had on the flora and fauna depends on the natural resources that humans use. Anthropogenic degradation and resulting fragmentation of Madagascar's forests has helped lead to the decline of many endemic flora and fauna species, including lemurs (Godfrey et al. 1997) and avifauna (Langrand and Wilmé 1997). However, the magnitude of the human effect of forest clearing depends on population density (Dewar 1997:373). In addition, since human populations were low when the catastrophic extinctions occurred in Madagascar, the loss of flora and fauna due to forest loss is only a more recent phenomena (Dewar 1997:373). Due to a range of

causes, the flora and fauna of Madagascar have experienced drastic changes over the past 2,000 years. The causal relationships of this decline must be understood locally, within specific regions of Madagascar, before the causal relationships affecting the entire island of Madagascar can be assessed (Dewar 1997).

The relationships between people, the environment and conservation interests (government and non-government) are complex and will no doubt attract anthropological interest for years to come. However, the history and culture of the Malagasy people must continue to be a part of the context in the design of conservation activities in Madagascar. If the rate of forest degradation continues, the biodiversity of Madagascar is in great peril. The international concern that Madagascar has been able to generate by being a "conservation hotspot" will help conservation efforts succeed due to increased awareness and funding opportunities. However, even an increase in funding will not slow current degradation of Madagascar's environment without addressing the larger issues, such as overpopulation. The current insight that anthropological research has offered to conservation projects in Madagascar is to include the local people as participants at every stage of the conservation program. However, the time and energy needed to take into account the history, traditions and customs of one or more communities of the local area for any one conservation project are enormous, but may be the only viable solution available for conservation in Madagascar.

Chapter 4. Cultural Models

In cognitive anthropology, analyses of cognitive processes and knowledge have been using the concept of cultural models for more than twenty years. Cultural models have been explored in several different domains of human knowledge, for example cosmology (Watanabe 1983), open ocean navigation (Hutchins 1983, 1994), and marriage (Quinn 1987). The agricultural rituals of the Malagasy, which are the topic of this research, constitute a cultural model. This chapter begins with a discussion of schema theory, the direct theoretical predecessor to cultural models in cognitive anthropology. Schema theory provides the fundamental tenets with which to understand cultural models both in theory and in application. Following this contextual background, I review the anthropological literature that uses cultural models as a tool to describe cultural phenomena.

4.1. Schemas

The term 'schema' was suggested by George Mandler (1984) to have been in use as early as Immanuel Kant (1929 [1781]), when Kant described a canid's recognition of other creatures as schema. However, it was not until the early 1970s that schemas were applied to the human condition and became a part of cognitive anthropology's repertoire for identifying and describing human thought. Schemas are cultural constructions of human thought that are used to process information. Individuals share schemas with other's in their cultural group, which in turn allows symbolic communication about complex ideas and/or processes. Put concisely, a schema is defined here as a culturally bound cognitive representation that enables the interpretation of data by a person or group and possible reaction to that information by applying contextual data to a set

pattern of thought. The contextual data enables interpretation of external stimuli through use of the schema as a way to 'think through the problem' by placing the data in empty 'slots'.

To further illustrate what a schema is and how they function, an example of a writing schema as described by Charles Filmore (1975) will be used. Filmore described the activity of writing as involving a writer, implement, writing surface, and product (D'Andrade 1995:123). The writer, implement, writing surface, and product constitute blank 'slots' that are filled in by specific data taken from the context of the situation in which the schema is applied. As an example, the 'slots' could be filled in as follows: the writer - a professor; the implement - chalk; the writing surface - a chalkboard; and the product - a lecture outline. If the individual using the schema to interpret what was happening around them were a student, the context, no matter where the activity is occurring, the interpretations would still be a classroom. The reaction of the student, hopefully, would include taking notes and intense attention.

Changing any one of the data slots in a schema may or may not change the results. In the example described above, if one replaced chalk with dry markers and the chalkboard with a whiteboard, there should not be any change in the interpretation or reaction by the individual using the schema. However, this writing schema, as well as all other schemas can interpret different environmental data to arrive at different conclusions. For example, if the 'slots' in the writing schema were changed to bird watcher, typewriter, white paper, and newsletter, the interpretation could be someone writing a newsletter for a bird watching/ornithological organization to which they belong. Therefore, the activity schema of "to write" can function to represent several different

activities (e.g., writing a novel or writing graffiti on a wall) as different data may fill the "slots", but all uses of this schema ultimately result in the transmission of language in a written form.

Schemas do not stand alone, but embed within and relate to other schemes. This embeddedness leads to a hierarchal complexity where multiple schemas are subsumed within one schema and several schemas may be found at similar levels of the hierarchy (D'Andrade 1995:124). For example, the writing schema contains the writing instruments subschema, which may include pens (e.g. ballpoint, felt-tip, or hieroglyphic) and pencils (e.g. mechanical, number two, or carpenters) among a myriad of other items. These hierarchal relationships enable the discovery of the relatedness of one schema to another through ethnographic methods. As noted previously, the writing schema is related to writing instrument subschemas as well as writing surface subschemas (e.g. paper, wall, or computer), product subschemas (e.g. newspaper, novel, or magazine) and others (D'Andrade 1995:124). Therefore, a holistic understanding of any one schema includes understanding of its relatedness to other schemas.

In addition to this embeddedness, schemas also have the qualities of prototypicality and failure. Prototypicality refers to the default values that a person or persons use to fill in the slots of the schema. For example, D'Andrade states that his personal prototypical values for the writing schema "invoke someone writing a message in English on a piece of white paper with a pen" (D'Andrade 1995:124). Prototypical interpretations are the standard expectations that someone has for their default interpretation of the schema. These default expectations do not represent a schema in and of themselves because they are unalterable due to context. By definition, schemas are

composed of blank 'slots' that are filled in by context driven data. Finally, schemas have the failure feature, which are the conditions by which the schema fails. For example, "the term scrawl refers to a failure to make one's writing on something legible, the term illiterate refers to someone who is not able to utilize the writing schema because they cannot read or write effectively" (D'Andrade 1995:124). In this example, it is when the communication between two or more individuals fails that the schema fails.

With the addition of schemas to cognitive anthropology's repertoire in the early 1970s, many studies have used schemas to describe the cognitive processes of cultural thought. For example, schemas have been used to describe college romance (Holland and Skinner 1987), germs and illness (D'Andrade 1976, 1995:126-130), the body as a container (Johnson 1987), typological nature of grammar (Talmy 1978), the English preposition "out" (Linder 1982) and "over" (Brugman 1981), and the grammar of natural languages (Langacker 1987, 1991). Schemas continue to be a useful tool for describing culture, but now interest has turned towards the use of schemas for understanding other cultural phenomena.

4.2. Cultural Models

While there is an implicit link between cultural models and schema theory, the use of the cultural model concept predates cognitive anthropology. The concept of cultural models is attributed to Kenneth Craik, who used cultural models to describe the decision making process where past experience and knowledge are used to solve a problem (1943). Therefore, in Craik's synthesis, cultural models are simply complex schemas that one can use in problem solving. D'Andrade writes that the main difference between a cultural model and a schema is that, by definition, a schema must be simple

enough to be held in short-term memory and anything more complex is a cultural model (D'Andrade 1995:152). D'Andrade states that cultural models consist of one or more semantic relationships (schemas) that organize the elements of cognition into interpretive frameworks used to describe internal or external phenomena (1995:151).

Several authors (e.g., Kronenfeld 2000, Shore 1996, Strauss and Quinn 1997) who take cultural models as their level of analysis have developed a descriptive definition of cultural models. The first aspect of cultural models that is evident in the literature is that cultural models are shared representations of common knowledge. In this logic, schemas are therefore defined as individual perceptions subject to individualistic experience as opposed to shared cultural models (Strauss and Quinn 1997:122). It is this group quality rather than individual knowledge that makes cultural models elusive, since the level of any analysis of cultural models must incorporate individual knowledge as representative of group knowledge. Complicating this further is the fact that individuals may be participants in several groups. To define knowledge communities, one must begin by verifying group membership. However, the amount of "sharedness" that is necessary for a determination as a cultural model and not as an individual schema is not always quantifiable, but may be determined by the researcher's "taste" (Strauss and Quinn 1997:122). There are not inherent mechanisms within the cultural model concept to determine to what degree individuals in the culture share the model. There is a further explanation of this concept discussed later in this chapter within an introduction of consensus analysis.

The difference between a cultural theory and a cultural model is made clearly by D'Andrade: cultural theories are "an interrelated set of propositions which describe the

nature of some phenomena" and cultural models are "a schema or interrelated set of cognitive schemas used to represent something, to reason with or to calculate… [and] are not formulated as explicit declarative knowledge (as in a theory), but are implicit knowledge" (1995:180). However, in practice, the use of propositional statements are mixed between cultural models (e.g., Kempton, Boster, and Hartley 1995) and theories (e.g., Lutz 1987, note that this article appeared in Holland and Quinn's "Cultural Models of Language and Thought"). The usefulness of this distinction was noted by Quinn, when confronted with differing results between her and another's research on a marriage, she stated that in her own analysis "interviewees are using a cultural model, while Bellah et al. (1985) appear to have singled out discourse in which their interviewees are theorizing" (Quinn 1996:397). In addition, Shore defines theories as fulfilling the function of a conceptual model, which "provide communities with a conceptual picture of a complex state of affairs" (1996:65). It appears to be problematic to differentiate what cultural knowledge or behaviors would constitute distinction of a theory from a model, this may be the reason why the term cultural model has found favor in the literature and cultural theory has not.

Another issue found frequently in the literature is the problem of discovering meaning to cultural models through language. Cultural models may or may not be linguistically based, yet often the only way to represent the model is through propositional statements, diagrams, statistics, and written descriptions that demonstrate the relationships between linguistic terms and categories (e.g., Boster and Johnson 1989, Garro 1988, Kempton 1987, Linde 1987). Yet, as has been argued by Kronenfeld (1996), the expression of thoughts through language may only have "loose and indeterminate

relationship" to each other (Kronenfeld 2000:5). This disparity is due to the phenomena of the isolation of thoughts from the interactive contact with culture. Therefore, for language to function as a proxy to thought, there must bee a continual sharing of the thought and the language referents throughout the group formation and reformation of cultural knowledge and models. In addition, the methods used by ethnographers to represent cognitive cultural models are not the same as the group's construction of their own cultural model. This problem is illustrated in a synthesis by D'Andrade (1995:152-158) of the Caroline Island navigation model from several sources (Finney 1979, Gladwin 1970, Hutchins 1983, 1994, Lewis 1972). D'Andrade illustrates the etic and emic constructions of star tracks used by the Carolinians to navigate between islands (see Figure 4.1).

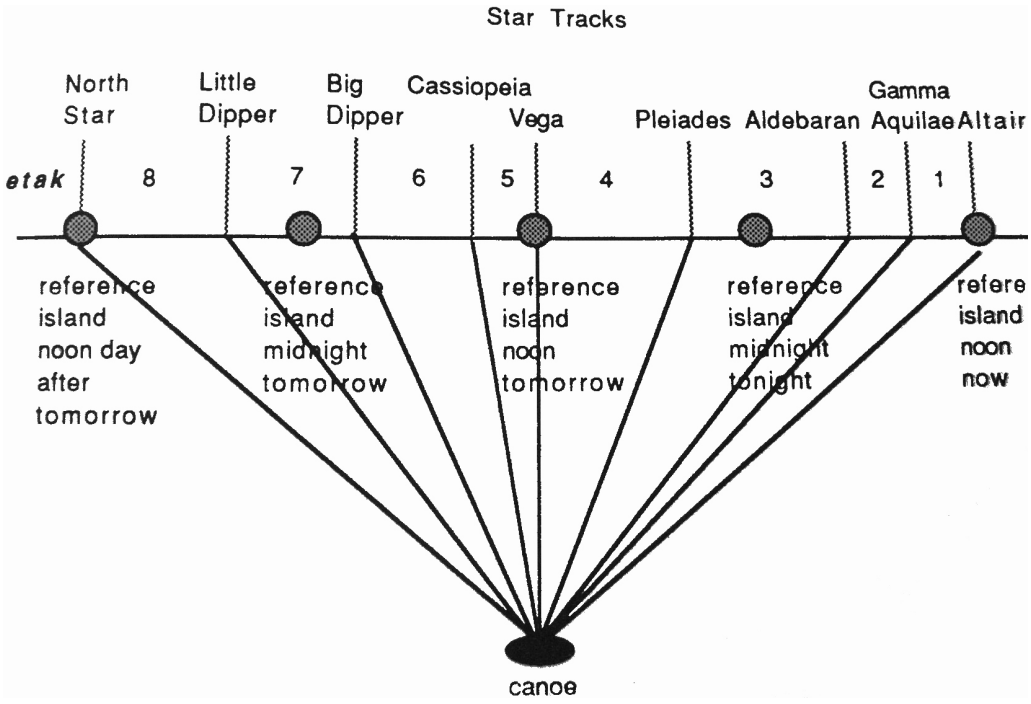


Figure 4.1. Emic construction of Caroline Islander star track cultural model (Figure 7.2 in D'Andrade 1995:155)

However, this model, as represented in the diagram, is the analyst's construction

of a shared cultural model not the structure of thought shared between members of the cultural group. This is not to say that ethnographers cannot capture the relationships and meanings ascribed by a particular culture, only that their methods of representation are different. Thus, the problem becomes twofold; language representation may not represent thought either from the point of view of the informant or ethnographer. In addition to the examples noted above, research on cultural models has included land tenure rights in the Trobriand Islands (Hutchins 1980), gendered life course of Mexican men and women (Matthews 1992), romance in America (Holland and Skinner 1987), marriage in America (Quinn 1982, 1987, 1996, 1997a, 1997b), and environmentalism in America (Kempton, Boster, and Hartley 1995). Much research has also been done on the construction of cultural models of illnesses in medical anthropology, for example high blood pressure (Garro 1988), hyper-tension (Blumhagen 1980, 1982), depression (Good, Good, and Moradi 1985), chronic pain (Good 1992) and epilepsy (Good and Delvecchio Good 1993). From the aforementioned examples, including other work on cultural models, one could extrapolate that there are cultural models of every domain of human higher-level thought.

To make sense of the structure of the realm of cultural model domains, Bradd Shore (1996) suggests a taxonomy of cultural models. The first distinction that Shore defines is the difference between 'mental models' and 'instituted models'. Kempton, et al., made this distinction clear when they described mental models as an individual's simplified representation of the group's shared cultural model (instituted model) that allows the interpretation of observations, the generation of novel inferences, and solutions of problems (1995:10-11). In other words, mental models are the individual's

interpretation of the group's model that is constrained by the individual's particular history and experiences. Environmental factors constrain mental models, both on the cultural and individual level. Mental models are what ethnographers elicit during interviews and must then compare across informants to find what information is shared that would constitute a shared cultural model of the group. There is a discussion on how to accomplish this in a later chapter.

Furthermore, Shore argues that differentiation of mental occurs at a deeper level by being either personal mental models or conventional models. Personal mental models are idiosyncratic in nature, created independent of a group by an individual to construct meaning structures to respond to novel situations (Shore 1996:46-47). An example used by Shore to illustrate personal mental models is the creation of a neighborhood map in the mind of an individual without regards to any shared cultural knowledge of the placement of locations on a map (1996:46). It is questionable how much of the information used to make this map is noncultural, as shared knowledge of where places are located may be involved. Conventional models, on the other hand, are shared by the group to respond to regularly occurring situations, either in relation to others in the group or independent of the participation of others (Shore 1996:47). Shore's example of conventional models is an American handshake, which is bound by cultural traditions and internalized by an individual (1996:47). While Shore's differentiation between internalized models (personal mental models) and culturally managed models (conventional models) is useful for analytical purposes, he has not made a convincing argument that personal mental models are not subject to external cultural input. For example, in Shore's example of the mental neighborhood map, to what degree is the map

constrained by an individual's cultural knowledge of measuring distances, identifying important landmarks, and constructing images of buildings? Regardless of the eventual need to use this internal map to give directions to a lost passerby or friend to your house, to what degree is thought assumed not to be negotiated through culture? Although Shore's assumptions about innate versus cultural knowledge, differentiation between internal and external models of thought may assist an ethnographer distinguishing between individual versus group thought, it is not clear to what degree cultural information may in integrated within an individual's mental model.

Shore's most useful contribution towards an understanding of cultural models comes from his taxonomy of cultural models. His primary delineation between two model genres, linguistic models (scripts, propositional models, sound symbolic models, lexical models, grammatical models, verbal formulas, and trope models) and nonlinguistic models (image schemas, action sets, olfactory models, sound image models, and visual image models) (Shore 1996:56-60). It is important to note nonlinguistic models do have a language component, as informants use language to interpret nonlinguistic phenomena and as soon as the ethnographer writes the knowledge, it becomes linguistic. Linguistic models have been mostly the concern of cognitive anthropologists, whereas nonlinguistic models have received far less attention. This is due to the reliance on linguistic models of thought and subsequent use of linguistic methods for understanding how information is processed. This reliance on linguistic models is also puzzling, in that several cognitive studies on folk biology have made use of nonlinguistic stimuli to elicit similarity judgments and subsequently propose a model of the shared cultural beliefs (e.g., Boster and Johnson 1989). Despite the general lack of

attention that nonlinguistic models have had with cognitive anthropologists, the differences and similarities in the use of linguistic and nonlinguistic models is of particular relevance if one wishes to ascertain the cognitive use of symbols in language and other modes of thought. The importance of this is that if an analysis of cultural models, in this case linguistic, presents the model in diagram or image form (nonlinguistic), the disparity between the two forms must be understood and explainable to be considered valid. Shore makes a secondary delineation of cultural models based upon their function:

I. Orientation Models
    a. Spatial Models
        i. Area Maps
        ii. Navigational Models
        iii. Route Maps
        iv. Models of Interpersonal Space
        v. Context Markers
    b. Temporal Models
        i. Incremental Models
        ii. Decremental Models
        iii. Cyclical Models
        iv. Rhythmic Models
        v. Biographical Models
        vi. Context-framing Devices
    c. Social Orientation
        i. Models of Social Relations
        ii. Social Role Sets Model
        iii. Emotion Model
    d. Diagnostic
        i. Medical Diagnostic Models
        ii. Checklists
        iii. Divinatory Models
        iv. Meteorological Models
II. Expressive/Conceptual Models
    a. Classificatory Models
    b. Ludic Models
    c. Ritual and Dramatic Models
    d. Theories
III. Task Models
    a. Scripts

b. Recipes
c. Checklists
d. Mnemonic Models
e. Persuasion (1996:61-67)

The extensive listing of Shore's functional types is important when addressing an earlier critique of D'Andrade's lack of developing exactly what makes a cultural model distinct from any other form of complex thought. Shore's taxonomy of cultural models provides the key component that distinguishes cultural models from other forms of cultural knowledge; models function to interpret phenomena, whether it is social, internal or external to the group and/or individual. Thus, orientation models function to interpret location; expressive/conceptual models function to organize, classify and interpret environmental and cultural information; task models function to solve problems.

The final difficulty that has arisen within the literature on cultural models is the question concerning to what degree does a model need to be shared to be considered a cultural model, rather than a mental model? At least one author, Linda Garro (1988), has partly found the answer through the use of consensus analysis (e.g., Romney, Weller, and Batchelder 1986). In Garro's paper (1988), she examined the variation and consensus of Ojibway Indian's knowledge about high blood pressure. Garro places her approach to high blood pressure in context with a critique of Blumhagen's (1980, 1982) work on hypertension, which she claims as incomplete due to the inability of the study to show that the cultural model of hypertension is shared by the community (1988:99-100). Through her analysis, Garro illustrates how cultural consensus analysis can quantifiably measure the degree of each informant's shared cultural knowledge about high blood pressure with the rest of her sample (1988:104-108). Garro believes that a shared cultural model exists by the high level of consensus of knowledge about high blood

pressure within the community (1988:115).

However, in a later paper, Garro (2000) examines how consensus theory and cultural models present distinct pictures of individual and group knowledge. Garro begins her examination by noting that the goal of cognitive anthropology is to understand how knowledge is remembered, transmitted, shared and how the hardware of the brain functions to enable these functions (2000:277-280). She characterizes cultural consensus theory through a review of the initial framework (Romney, Weller, and Batchelder 1986) and subsequent refinements (Romney 1994, Romney 1999, Weller and Romney 1988) as having the ability to determine informant memory of cultural knowledge as compared to the group's consensual knowledge (Garro 2000:280-283). Garro's critique of consensus theory echoes Boster's (1987) characterization that consensus theory assumes that knowledge consists of discrete segments of information and that they may be counted and correlated (Garro 2000:284). In addition, Garro cites D'Andrade (D'Andrade et al. 1972, D'Andrade 1976) where he observed that it is unlikely that informants retain a large number of segments of information in memory, but rather process information through propositional statements that are used for several problem solving situations (Garro 2000:284). Following her discussion of consensus theory, Garro reviews cultural models and observes that variation among individuals in their application and knowledge of a cultural model may reflect context in which the model is applied, use of different schemas and/or different aspects of the same schema, or relying upon a different hierarchal level of the cultural model (2000:285-287). Given the differences in the informant's use of the cultural model, determining the degree to which the informant's share the model becomes difficult.

After the discussion of the theoretical background to her analysis, Garro proceeds to illustrate her use of cultural consensus and cultural models to analyze the beliefs on the causes of diabetes within an Anishinaabe (Ojibway) community (Garro 2000:288-309). Garro concludes that cultural consensus, while isolating knowledge for further analysis, does not represent knowledge about diabetes because this knowledge is not purely memorized information, but negotiated through socially constructed personal experience (2000:312). Specifically, the Anaishinaabe do not understand the causes of diabetes through a memorized list of symptoms, but through their individual experiences with the disease and their socially constructed knowledge shared with others that have the disease. On cultural models, Garro finds that even though the model of the causes of diabetes is shared among the Anaishinaabe, the way the model is used differs among informants (Garro 2000:312).

4.3. Conclusion

For the purposes of discovering cultural models of *tavy* in Madagascar, cultural models consist of one or more semantic relationships (schemas) that organize the elements of cognition into interpretive frameworks used to describe internal or external phenomena (D'Andrade 1995:151). To determine the sharedness of the cultural model of *tavy*, the methods outlined by Romney, Weller and Batchelder (1986) are used to statistically test the degree to which propositional statements of the cultural model of *tavy* are shared among communities. The identification of the specific schemas of *tavy*, how these comprise a cultural model of *tavy* and their sharedness comprise the following chapters.

Chapter 5. Field Methods

The first field season in Madagascar was during the summer of 2001, when the University of Toamasina granted me permission to perform research in Eastern Madagascar and study of the Malagasy language began. Interviews of Malagasy governmental and non governmental agencies occurred during fieldwork in 2003 (January through July). Farmers were interviewed intermittently during this same period as well as during a fieldwork in 2004 (May through July). All interviews took place with one or two Malagasy interpreters and were conducted as open ended discussions during the 2003 field period and as survey instruments in the 2004 field season. None of the agencies declined to be interviewed. Only a few rice merchants and only one rural farmer declined to speak to the author about rice and *tavy*. All informants that were interviewed expressed interest and welcomed the opportunity to speak about the agricultural problems in eastern Madagascar.

5.1. 2003 Field Season

The initial fieldwork lasted six months (January through June 2003) in Madagascar, when a linguist from the University of Antananarivo taught the eastern dialect of Malagasy to the author for three months as well as providing general cultural information. With the aid of a local university student serving as an interpreter, the remaining period of this field season occurred in and around Toamasina interviewing governmental and non-governmental agencies, market rice sellers and rural farmers.

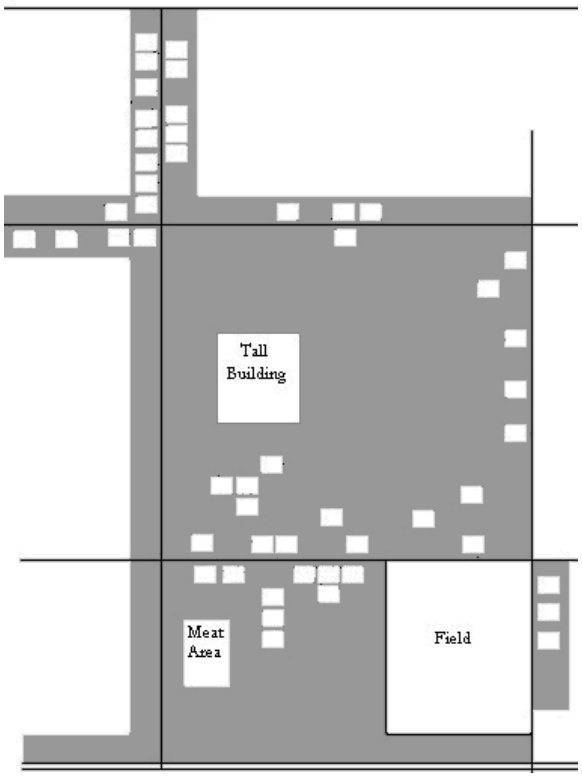


Figure 5.1. *Bazary Kely*, Toamasina (squares denote rice merchants and grey area denotes limits of bazaar)

This study included the interviewing of all agencies that had any direct relationship with agriculture and conservation. In these agencies, the individuals interviewed were not only the directors of these agencies, but in all cases, personnel that worked with local people on the ground. The topical focus of interviews was role of that particular agency had in the development or conservation of eastern Madagascar's resources as well as what, if any, solution was being implemented. In addition to the agencies, informants included market rice sellers in *Bazary Kely* (one of the largest bazaars in Toamasina). These merchants discussed the changes of rice prices and their understanding of what types of rice customers prefer. Merchants were asked not only to describe what the differences between different rice types were, but were asked to complete a successive pile sort task (using small pieces of paper) those types that were

similar to and different from each other. The pile sort task was not successful, as the instructions provided to the informants were incorrect due to translation errors. Each rice merchant in *Bazary Kely* had an opportunity to take part in the interview and only five declined of fifty-two. The result of these interviews was the basis of the discussion of the stakeholders presented in a later chapter.

With the aid of a technician from FOFIFA, rural farmers in two communities along the main highway (Route National 2 (RN2) between Antananarivo and Toamasina participated in the interviews. On the way to one community, the hired vehicle broke down. The driver needed to return to Toamasina for parts. The break down occurred near a village and while the driver was repairing the vehicle, several of the villagers agreed to participate in interviews. The technician from FO.FI.FA knew the second community because of a planned agricultural development project in the vicinity. In both of these communities, farmers spoke about their methods of agriculture and the rituals performed while growing rice. There were approximately thirty extended structured interviews with the farmers in this area. Directly following fieldwork in Toamasina, there was an initial contact of local authorities for continued research in the Andasibe region and several additional interviews occurred. The result of this field season was an improvement in the knowledge and use of the Malagasy language for use in interviews and the construction of a cultural model of *tavy* from the qualitative data collected.

5.2. 2004 Field Season

The variation in responses when questioned about the items offered during rituals appeared to coincide with the degree of information that the agencies gave the farmers regarding sustainable agriculture, which directly lead to the formation of the hypothesis

of this research, that as knowledge of non-indigenous conservation practices increases, knowledge of *tavy* decreases. In the summer of 2004, the study consisted of 185 farmers in the Andasibe region (mid-level rainforest in eastern Madagascar) in three communities to test whether information given to the farmers by conservation organizations was affecting their ritual practices. The three locations for interviews were: (1) Andasibe – a city with an estimated population of 5,000, (2) Mahatsara – a village with an estimated population of 250, and (3) Ampangalatsary a region with many small-interspersed communities and an estimated population of 1,000. Communities in Andasibe and Ampangalatsary were also split, where at least five Betsimisaraka farmers were interviewed from each community. The informants who were chosen were those that were at their homes and available for interviewing (many were either in their fields or away on business during the day). Interviews continued in each community with any ethnicity until reaching the sample size of five Betsimisaraka. Interviews did not include individuals that were under 18 years old or had not done *tavy* (see Appendix 3 for informant sample information). Andasibe is an ethnically diverse town that was a major logging center and now is the center for two local mines and a railroad construction agency. Mahatsara village (approximately 8 kilometers north of Andasibe) contains mostly individuals from the Mantadia National Park nearby that choose to settle in a village created by the local conservation authority, ANGAP. Ampangalatsary (approximately 4 kilometers south of Andasibe) is a region along the national road (RN2) that contains immigrants to the area from up to 30 kilometers south of their present location.

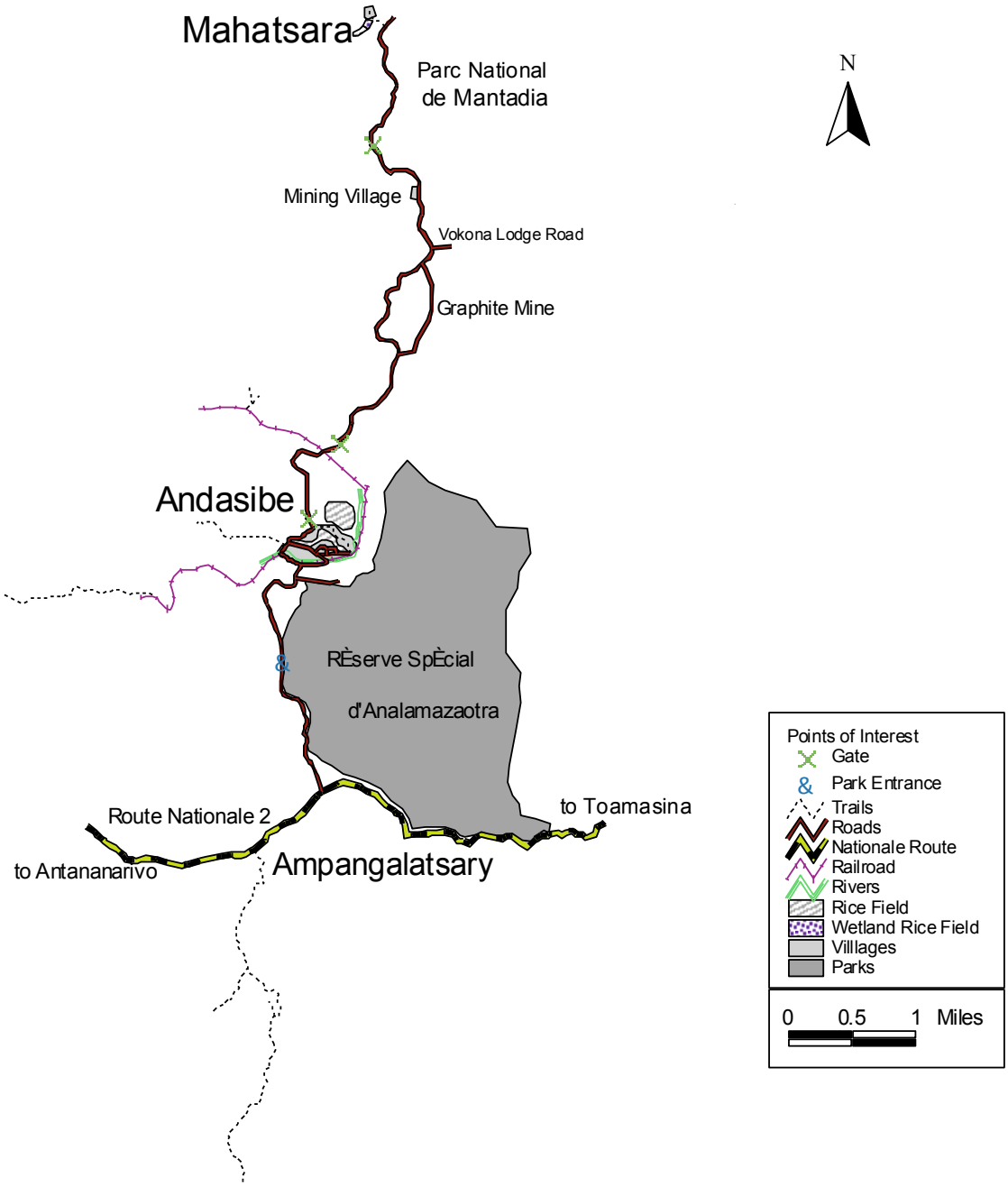


Figure 5.2. Commune Rurale Andasibe

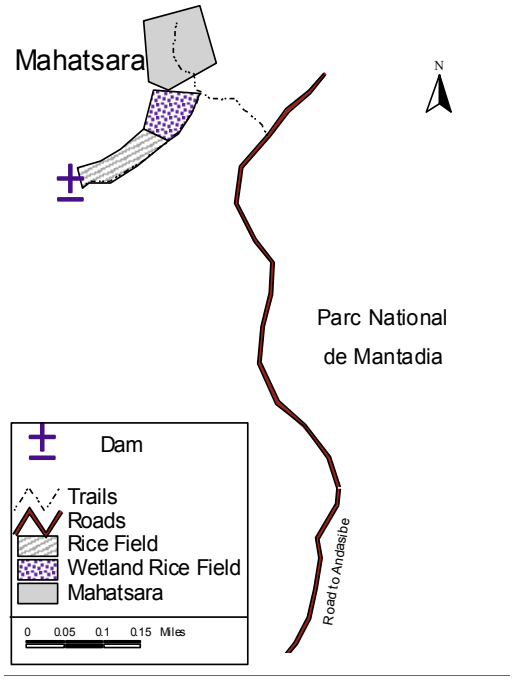


Figure 5.3. Mahatsara

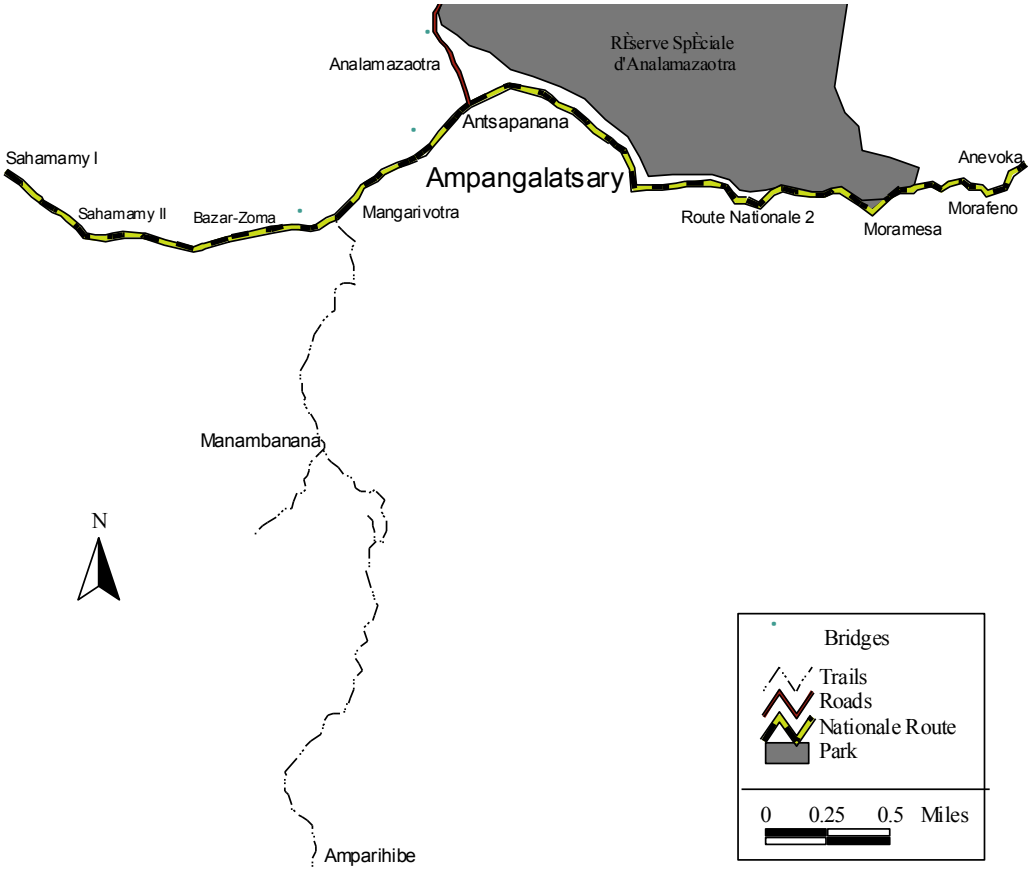


Figure 5.4. Ampangalatsary

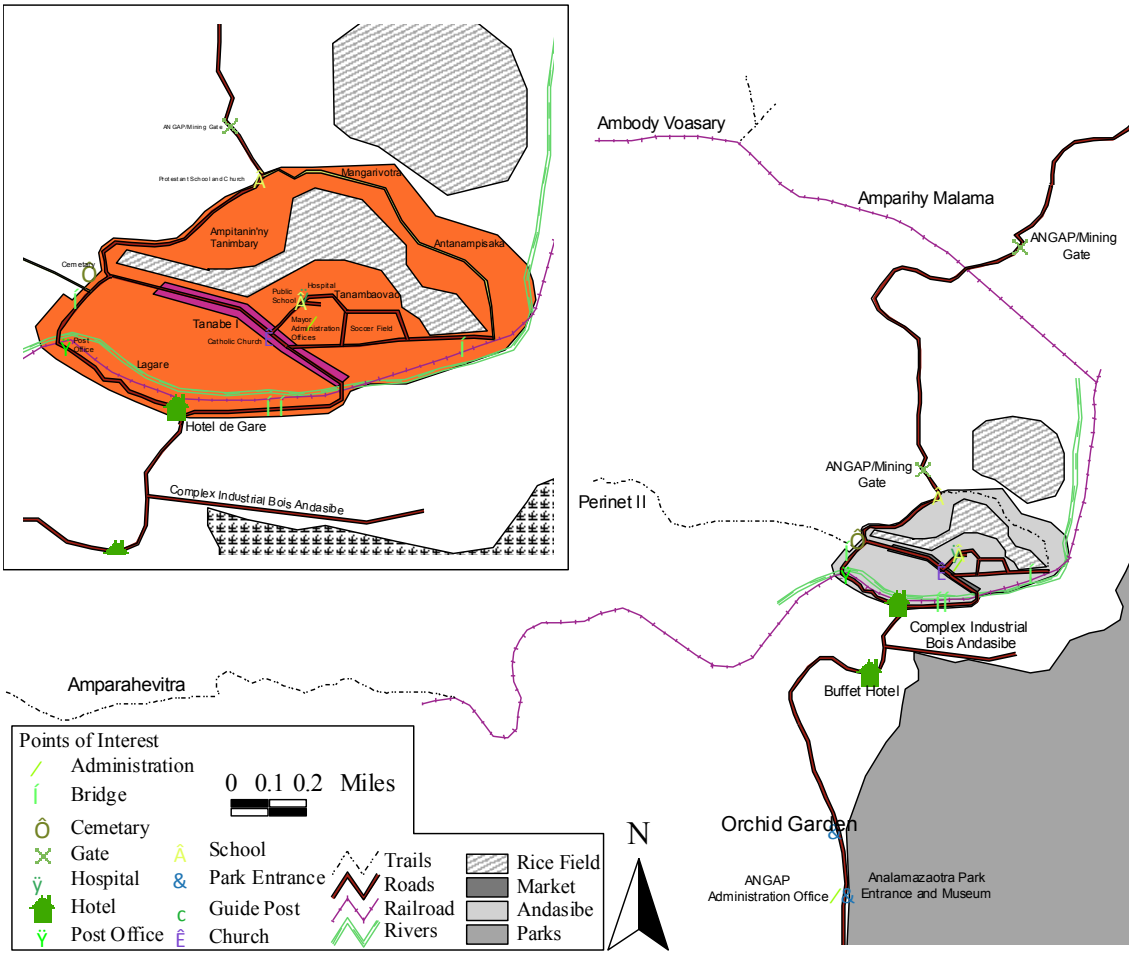


Figure 5.5. Andasibe

The three particular sample populations were chosen because of their varying degree of connections with conservation organizations. Mahatsara village developed during the relocation of people from Parc National de Mantadia by ANGAP, continues to have strong connections with the local conservation authority (ANGAP) and MEF. Andasibe is equal distances from Mantadia national park and Analamazoatra special reserve and is the base of operations for seven national and international conservation organizations. Ampangalatsary, while near both the Reserve Speciale d'Analamazoatra

and Reserve de Maromizaha[3], and is not subject to the ongoing efforts of the conservation organizations operating in the vicinity, but does have influence from MEF. It was believed that Ampangalatsary would show high ritual knowledge and Andasibe low with Mahatsara falling somewhere in the middle, all coordinating with the amount of influence that the conservation organizations had with the sample populations.

The first step of the survey was the creation of a survey instrument designed to collect both demographic and ritual performance data. Initially translated from English into Malagasy by a research assistant, they were later corrected by collaborators at the Institut de Civilisations / Musée d'Art et d'Archéologie de l'Université d'Antananarivo (see Appendices 1 and 2). The following demographic information was collected: age, ethnicity, religion, years lived in the area, years farming, items grown, other supplementary occupations, irrigated agriculture experience, and the last time *tavy* was performed. Although there are many ethnicities in the area, the Betsimisaraka[4] were the focus of this research as the area is part of their regional home (149 of the 185 total informants identified themselves as Betsimisaraka). The cultural model of *tavy* consisted of five ritual schemas and informants reported to which spiritual being each ritual associated and which of the possible five offerings were appropriate. The following is

[3] The Reserve de Maromizaha is part of several German conservation organizations (Fondation Natur-Und Artenschutz in den Tropen, BIOPAT Partnerschaften für biologische Vielfalt, Kölle Zoo and Zoologisch-Botanischer Garten Wilhelma.) who are attempting to protect the biodiversity of Madagascar's eastern rainforests. At the time that research was being completed in the Andasibe area, representatives for this conservation project could not be contacted.

[4] The questions of ethnicity is problematic in Madagascar as the current understanding of ethnicity is highly politicized. For example, the Betsimisaraka were united as one ethnic group from several smaller groups in the early 18th century by Ratsimilaho to strengthen the Malagasy interests against foreigners in trade and political power. As a result, the identification of someone as Betsimisaraka is almost identical to the location that they live, eastern Madagascar, rather than some idea of their ethnicity being cultural content. While the category of ethnicity remains problematic, it was used in this research at the request of collaborators.

the survey's four-point scale:

English	Malagasy
1. Completely agree	1. Mifanaraka araky izany mihitsy
2. Somewhat agree	2. Mifanaraka eo eo ihany
3. Somewhat disagree	3. Tsy mifanaraka eo eo ihany
4. Completely disagree	4. Tsy mifanaraka araky izany mihitsy

Depending upon what the informant's answers were to these questions, follow up questions were asked to determine why some offerings were thought appropriate or not.

The phrasing of the questions for the survey assumes that reported knowledge of an action relates to acceptable behavior. The phrasing of the questions as "you should" do something (see Appendix 1) is an attempt to measure acceptable behavior rather than whether the informant knows of a particular behavior or reports a normative behavior. It is entirely plausible that the reported acceptable behavior does not have any relation with actual behavior, but within the confines of limited time and resources, following each individual informant while they practiced *tavy* was not feasible. It is acknowledged that the relationship between what an informant states they should do and what they actually do is spurious at best, but at least shows that the reported acceptable behavior does, in fact, reflect agreement and disagreement among informants in their perception of *tavy* practice.

While collecting data on the cultural model of *tavy*, the number of conservation organizations working in each of the sample populations was determined. This data will be used later to determine the effect they have on *tavy* knowledge. Andasibe currently has seven conservation organizations working with the local population which include the following: the Association Nationale pour la Gestion des Aires Protégées (ANGAP), Ministère des Eaux et Forêts (MEF), Association Mitsinjo, Stiftung Natur und

Artenschutz in Den Toten (NAT), United States Agency for International Development (USAID), World Wildlife Fund (WWF), Sampan'Asa momba ny Fampandrosoana - Fiangonan'i Jesoa Kristy Eto Madagasikara (SAF-FJKM), and Adventist Development and Relief Agency International (ADRA). Mahatsara has three conservation organizations working in the village (ANGAP, MEF and SAF-FJKM). Finally, Ampangalatsary only has one conservation organization actively working with the local population, the MEF.

5.3. Statistical Analysis

Statistical analyses of the collected data began in the field by using SYSTAT 10.2 and SAS Version 8 for Windows statistical software packages on a laptop computer. Factor analysis of the inter-informant agreement matrix was used to explore the pattern of intra-cultural variation in the cultural model of *tavy* (Boster 1981, 1984, Romney 1994, 1999, Romney, Weller, and Batchelder 1986). Factor analysis provides a way to test whether or not the variation is around a single cultural model. In addition, this method allows one to determine the culturally 'correct' answer without the researcher's prior knowledge (Romney, Batchelder, and Weller 1987). One can infer that informants have converged on a single cultural model if the first eigenvalue is several times larger than the second and if the first factor scores are all positive (Romney, Weller, and Batchelder 1986:323). In addition, Pearson's R statistics determined whether the differences between the knowledge of different community members were significantly different. The result of this analysis will show what aspects of the cultural model the three subpopulations share.

Chapter 6. Stakeholders

Although there are excellent reviews on the relationship of conservation and cultural practices among the Malagasy (e.g., Dolch 2003), they ignore the ritual and cultural impacts such a change would invoke, citing lack of knowledge, property rights or environmental constraints as the hindrances responsible for the failure of switching from *tavy* to wet field agriculture (e.g., Ford 1996, Kistler and Spack 2003, Oxby 1985). While lack of technical knowledge, land-tenure rights, economic means and the current degraded state of the environment certainly constrain the ability of Malagasy farmers from changing subsistence patterns, the effect of such a change on the farmer's belief systems may also constrain agricultural change (e.g., Erdmann 2003). The few discussions about the ritual and spiritual aspects of *tavy* do not link belief systems with government assertions of farmer practices (e.g., Moor and Barck 1997). The interviews considered here are focused upon what the effects of a change from *tavy* to wet field agriculture would have on the cultural beliefs of the rural farmers. In consolidating the viewpoint of all of the local stakeholders in the agriculture of eastern Madagascar and its impacts on the environment it is useful to state the goal of each:

- MAE – Provide techniques to increase agricultural yield.
- FOFIFA – Provide crop seed that improves agricultural yield.
- EASTA – Train technicians in techniques to increase agricultural yield.
- MEF – Protect the remaining forests from destruction.
- ANGAP – Protect the national parks from destruction.
- Market Rice Sellers – Make living selling rice.
- Rural Farmers – Make enough food to feed themselves and their families.

It is clear that none of the goals of these stakeholders, on the surface, is mutually exclusive. The goals appear to be similar enough that, if the stakeholders are able to work together, they may find solutions to the agricultural problems in eastern

Madagascar that satisfy each of them. What follows is a discussion of the suggestions each stakeholder offers as a solution to the current agricultural problems in eastern Madagascar and what, if any, impacts this change would have for the cultural beliefs of rural farmers.

6.1. Ministère de l'Agriculture et de l'Elevage, Direction Inter Regionale du Développement Rural, Toamasina (MAE)

In addition to its other duties, the Ministère de l'Agriculture et de l'Elevage in Toamasina instructs rural farmers in innovative farming techniques to increase their crop yields (e.g., rice, corn, cassava, etc.). There are only the two agricultural technicians for the entire Toamasina Province, which comprises approximately 71,911 square kilometres (INS 2004), to aid farmers, one based in the city of Maroantsetra and the other in Toamasina. The technician based in Toamasina stated that there is not a solution to the current agricultural problems in Madagascar because the rural farmers were following their customs and they would not change their ways (MAE Agricultural Technician, personal communication, May 5, 2003). The technician's experience is that the introduced farming techniques are eventually abandoned for the traditional techniques. The director of the ministry stated that the problem could be narrowed down to five things: (1) lack of agricultural equipment, (2) lack of flat land in the province, (3) loss of topsoil by using a swidden farming method, (4) increase of human population, and (5) the extended length of time that the environment takes (approximately fifty-years) to become secondary forests after being cleared and burned (MAE Director, personal communication, May 5, 2003). His solution was to use a terraced wet field system, but he knew that this was an improbable solution due the economic constraints of the

ministry. He remains optimistic that an international non-governmental organization will provide the funds to develop agriculture in Madagascar.

6.2. Ministère de la Recherche Scientifique, Direction Inter Regionale Centre, Régional de Recherche Est, Toamasina (FOFIFA)

One of the branches of the Ministère de la Recherche Scientifique (FOFIFA), has the goal of providing hybrid and genetically engineered seed for the various crops grown in Madagascar. The director of the Toamasina branch of FOFIFA states that the problem of agriculture in Madagascar is fourfold: (1) social, (2) property rights, (3) technical and (4) economic (FOFIFA Director, personal communication, June 4, 2003). The social component includes education, communication and knowledge of new agricultural methods taught to the rural farmers from agricultural technicians. The property rights component results from that fact that the Malagasy rural farmers do not own the land on which they farm and the director believes land ownership as a key to the success of any agricultural development. The technical problem that FOFIFA is primarily responsible for solving is providing seeds that result in higher crop yield, be they rice, vanilla or other crops. Finally, funding of such programs is precarious and this may result in not allowing agricultural development to proceed. In sum, FOFIFA is attempting to solve the agricultural problem by introducing new technology (e.g., agricultural methods and hybrid seed).

FOFIFA has had a cooperative relationship with the International Rice Research Institute (IRRI) since 1982 with funding from USAID and other NGOs (IRRI 2004). The IRRI's stated goal is to promote a "green-green revolution" by concurrently increasing "the productivity of labor, water, and chemical fertilizers, while preserving natural

resources and protecting the environment" (IRRI 2004:1-2). The green-green indicates that this agricultural revolution will not only create green crops, but also in an environmentally friendly manner. In spite of how conservation friendly their stated goals are, the IRRI is primarily concerned with providing genetically engineered seed to increase rice yield. FOFIFA has had very limited success with the introduction of new rice varieties. For example, FOFIFA, with the assistance of the IRRI in 1983, introduced a new variety of wet field rice, designated R8, which eventually failed because 45 per cent of the rice kernels were broken when processed, which is unacceptable to consumers. Consumers believe that rice which contains very few broken kernels is better quality. Yet, the reported results of crop yields of 6 to 10 tons per hectare in experimental wet fields by the IRRI in the mid 1980s continue to provide the impetus for continued experimentation with high yield seed varieties (Vallois 1996:87). Currently FOFIFA is attempting to produce enough of another variety, designated B22, for use with swidden agriculture. They claim that this white rice can yield 3,000 kilos per hectare as compared to current varieties, which only yield about 1,000 kilos per hectare. They have been unsuccessful with the B22 variety because the farmers that grow the rice for seed consume the rice instead of selling the seed to FOFIFA for redistribution. The farmers would rather feed their families than sell rice at below market value back to F0FIFA. The director of FOFIFA claims that the farmers will use this new white rice variety even though there is a strong preference for red rice simply for the fact that the white rice yield is so much higher (Toamasina FOFIFA Director, personal communication, June 4, 2003).

The director at FOFIFA, Toamasina, stated that rural farmers do not have enough money to invest in a new farming system and they cannot afford fertilizers or herbicides

(FOFIFA Director, personal communication, June 4, 2003). In addition, other agricultural methods require more labour than *tavy*. The director suggests that farmers should organize into cooperatives so that the various departments and ministries can work with them at the group level to find solutions and perhaps eventually mechanize their agriculture (FOFIFA Director, personal communication, June 4, 2003). There are not enough resources available to FOFIFA to reach every individual farmer, but on a small scale, groups of farmers could be reached.

6.3. Ecole d'Application des Sciences et Techniques Agricole, Analamalotra, Toamasina (EASTA)

Eight kilometres north of the city of Toamasina lay an agricultural school (EASTA), which houses twenty students who are taught agricultural techniques in order to become agricultural technicians and who will in turn teach rural farmers new agricultural techniques. EASTA encompasses several hectares and has land available to teach techniques of agriculture by having the students practice the methods as class projects. The rice in wet fields is grown with the assistance of fertilizers and herbicides. The price to fertilize a one-hectare field costs about 10,000,000 Francs Malagasy (FMg; 1,600 USD[5]) and yield using this system is 3,500 kilos per hectare (EASTA student, personal communication, May 8, 2004). At average retail prices of 2,500 FMg (0.40 USD) per kilo for local rice, the rice for one hectare would be 8,750,000 FMg (1400 USD). Using this system, there is a deficit of 1,250,000 FMg (200 USD) per crop. The system of agriculture that is taught to the students at this school is not currently

[5] The conversions from Malagasy Francs to United States Dollars is based on the average currency conversion rates for May 2003 (6,250 FMG to 1 USD), which was the period when interviews at E.A.S.T.A. took place and average retail prices for local varieties of rice were collected in Toamasina markets.

economically feasible unless the government subsidizes the farmers, which with the current economic state of Madagascar, is highly unlikely.

6.4. Ministère des Eaux et Forêts, Toamasina (MEF)

The Ministère des Eaux et Forêts (MEF) in Toamasina monitors the agricultural practices located in unprotected areas of severely degraded mid-altitude rain forests in the Toamasina Province. The MEF process farmers' requests to practice swidden agriculture in these areas and provide *gestations* (legal papers) allowing farmers to do so. Rules governing the allowance of *tavy* include that the farmer must not grow crops on the top third of a mountain and only burn their fields during a designated period. Without this *gestation* the farmer can be fined and/or jailed. If there is an illegal fire and the responsible farmer cannot be identified, the village is fined 1,700,000 FMg (300 USD). Difficulty lies with the fact that the ministry is under staffed and under funded, so the areas that are not easily visited due to the lack of good roads are not regularly monitored.

The director of the MEF stated that the practice of swidden agriculture must end (MEF Director, personal communication, May 12, 2003). At current population levels and with the already rapid decline of the indigenous forests, *tavy* is not sustainable. He suggests that the solution to the current agricultural problems in eastern Madagascar is building dams to provide valleys with water for wet agriculture that will eventually result in the end of swidden agriculture. He believes this will be a difficult process, not only because of the funds needed for such a project, but that this process must be a cooperative one between the farmers and government, rather than forced upon the farmers.

6.6. L'Association Nationale pour la Gestion des Aires Protégées, Toamasina and Parc National D'Andasibe (ANGAP)

The agricultural practices of the communities located in protected areas are monitored by L'Association Nationale pour la Gestion des Aires Protégées (ANGAP). ANGAP serves as a Malagasy non-governmental organization that manages protected areas. Both of their offices, in Toamasina and Andasibe, affirm that the practice of *tavy* must end in order to protect the natural resources of Madagascar and to this end; they are beginning in and around areas that are under their protection. The process is reportedly slow in the areas around the reserves, as funding does not easily stretch beyond the borders of the parks (ANGAP Toamasina Branch Director, personal communication, May 23, 2003).

ANGAP was successful in transitioning one village within a park near Andasibe from swidden agriculture to wet agriculture by damming a small river and providing technical and financial assistance to farmers in the project (ANGAP Andasibe Branch Director, personal communication, June 12, 2003). Swidden agriculture has stopped in the park and farmers are requesting dams to provide even more wet fields. The director of the Andasibe branch understands that there is a 'culture' of *tavy* that must be understood before change can occur (ANGAP Andasibe Branch Director, personal communication, June 12, 2003). Even with this success story, on the edges, and even sometimes within the parks themselves, swidden agriculture is destroying forests protected by ANGAP. They have neither the funding nor personnel to completely stop swidden agriculture in their parks.

6.7. Market Rice Sellers

Sixty-seven rice sellers who were interviewed in markets within the city of Toamasina, many of which were or currently are rice farmers, told a different story than

the governmental officials. The rice sellers have an extensive knowledge of rice varieties and the locations in which they are grown as well as the preferences of customers. There are many varieties of rice found in the Malagasy markets. Factors that the customers take into consideration when choosing which rice varieties to buy include: (1) location of where the rice is grown, (2) method used to grow the rice, (3) approximate age of rice, (4) smell, (5) color, (6) amount broken and (7) shape and size of kernels. Regardless of price, the rice sellers all report that there is a strong preference for locally grown rice. The most common reasons the rice sellers report for why local rice is better than imported included the following: (1) it tastes better, (2) it is better for digestion (healthier), (3) it has more vitamins, and (4) it has no chemicals. Customers are also reported to prefer red rice over white rice as it is believed to have more vitamins. Among the local varieties both grown on wet fields and by swidden agriculture, both white and red – the red rice grown by swidden agriculture is preferred by the majority of the rice seller's customers. It is believed that red *tavy* rice is the most nutritious and healthy of all varieties of rice.

6.8. Rural Farmers

All of the farmers interviewed in Toamasina, Brickaville and Andasibe understood that swidden agriculture harms the environment, meaning the naturally growing forests. Though there were different reasons given for the degradation of habitat, the general understanding was that the environment was less healthy now than in past generations. However, they state that they have no other alternative than to practice *tavy*. They must feed their families and no one, neither the government as a whole nor any of the organizations listed above, is giving them any assistance. They are aware of

organizations that would help finance associations of farmers and train them in new farming methods, but they do not know how to go about getting this help. The farmers in Brickaville have knowledge of a government program to help them transition to wet fields and offers the ownership of land, but they know of other farmers that had examined the land and deemed it not acceptable for farming.

All of the farmers interviewed pursue both swidden agriculture and wet field agriculture. They grow their swidden crops on the sides or tops of hills and maintain wet fields in the valleys and by rivers. On their swidden fields, they harvest rice for two years and then harvest cassava for three years. They do not have enough land to let the land fallow for more than three years before returning to plant again. The farmers do assert that the rice yields have been diminishing over the years and cannot currently feed themselves and their families with the rice that they grow themselves, so must supplement their own rice by purchasing imported rice. The farmers report that they currently harvest 1,500 to 3,000 kilos of rice per hectare. They state that there is not enough good land for farming anymore on the East coast of Madagascar.

The farmers agreed with the assertions of the market rice sellers that red rice tastes better and it has more vitamins than white rice. In addition, the farmers stated that the white rice grown on wet fields in Madagascar has the same taste as imported rice, which is tasteless, as water. The farmers do not have many options when choosing which rice variety to plant each year, but use what they have on hand or what they can buy at a good price at the market.

The farmers suggested several solutions to the current agricultural problems in eastern Madagascar, but only two most commonly suggested solutions are addressed

here. First, rivers in valleys could be dammed and channels constructed so that more of the valleys could be used for wet rice agriculture. The farmers do think that this form of agriculture is more work, but if they were able to grow more rice and become self sufficient, they would do it. The Farmers believe that it would be good to own their own farmland, but do not see this as necessary to enable the ability to feed themselves. Second, they believe that the forest should be allowed to regrow or be replanted because the loss of forests has degraded the environment generally. One of the effects attributed to deforestation is that the climate is dryer and there is now less rain (desertification).

Recently during fieldwork in Andasibe (May through July 2004) farmers reported that they continue to pursue *tavy* for three main reasons. First, there is no other work in the region that they can do to make enough money to support their families. Second, there is no one that will teach them a better method for agriculture. All but one of the 187 farmers interviewed stated that they wanted to learn new methods of agriculture. Third, according to several farmers, rice will only grow on soil that is 'hot.' Since the Andasibe climate is cool, one must heat the soil for the seed to germinate and the plants to be strong enough to produce grain. The two methods to make the soil 'hot' are burning and fertilizer. Since the farmers cannot afford fertilizer, their only option is to burn so that their crops will grow.

In addition to the difficulty with earning money and trying to learn new methods of agriculture, the current inflation in Madagascar is affecting the farmer's ability to continue living in their current way. The price of rice rose from 2,250 FMg to more than 3,500 FMg in a matter of months. The price to take a *taxi-brousse* (local bus) to Moramanga has risen 5,000 FMg to 7,000 FMg. Moramanga is the nearest location from

Andasibe to buy medicines and for children to complete exams to continue their education in the public school system. In addition, the price of kerosene has risen 4,500 to 8,500 FMg per litre. Kerosene is used on a limited basis for cooking, but also as a form of cheap light in houses that do not have access to electricity. Life is quickly becoming more difficult for the rural farmers of Andasibe. To illustrate this point, when asked how the current inflation was affecting him, one elderly farmer responded, "It is not bad to be poor. It is alright not to have money to buy televisions and radios. Now we do not have enough money to buy food. It is bad to go hungry. I fear that the poor will revolt against the rich because they are hungry."

6.9. Comparison

According to these stakeholders, swidden agriculture is not sustainable as currently practiced in eastern Madagascar. High human population levels and limited available fertile farmland has resulted in shortened fallow periods (in some cases as short as two years), which in turn decreases the fertility of the soil, hastens topsoil erosion and reduces local biodiversity. The Malagasy government is implementing several agricultural and social policies designed to promote biodiversity conservation and increase crop yields to meet the increased needs of the rising human population. The remaining forests of Madagascar do not have only esoteric ecological value, but are a major source of revenue from ecotourists and international agencies. This revenue is essential for the economic viability of Madagascar's economy. The success of any conservation project must not only attempt to balance the economic costs and benefits for the participants involved in the change, but also take into account the political, agricultural, ecological and cultural consequences of the change. Thus, ending *tavy*

requires the collaboration of many agencies and groups.

The culture of *tavy* and its relationship to behaviour are being ignored by many of the stakeholders. *Tavy* is not just a method for growing rice, but is intertwined with ritual and religion. For example, when choosing a site to do *tavy*, preparing the site, burning the site and planting – prayers and offerings to ancestors, spirits and/or gods is practiced something that is not done when doing wet field rice agriculture. To illustrate this point, the rite of first harvest shows the connection between cultural beliefs and agricultural practice. During harvest, the rite of *Lango* (first rice rite as reported by farmers near Brickaville) is intertwined with symbolism and religious references:

1. Six heads of the rice are harvested by the farmer and placed in a bag.
2. A fire is started in a small hole, an iron box in placed over the fire and rice in placed in the box to dry.
3. The rice is removed from the husk by placing it in a bag and beating it with a stick.
4. The rice is then cooked in a pot over a fire and placed on a *ravanala* (travelers palm - *Ravinala madagascariensis*) leaf with honey, *betsabetsa* (alcohol made from rice and honey) and rum.
5. They then pray over the rice, led by the *tangalamena* (holder of the customs), to remove the *tsiny* (malicious spiritual powers) so that they may harvest the rice and bring it to their home, thereby bringing the health of the field into their home.
6. They may eat fish with the rice during this rite, but no other meat.

The transition from *tavy* to wet field methods will result in the loss of meanings ascribed to farming. All of the farmers that were interviewed practiced both *tavy* and wet field methods. Of all of the institutions and agencies that were previously contacted and interviewed, only one (ANGAP) recognized that understanding the cultural institution of *tavy* would be critical to success in the planned agricultural change. Most of the institutions and agencies assumed that change would be welcomed if it promised and actually provided net benefits, regardless of the implications to cultural beliefs that these changes will bring.

Chapter 7. Rice

Rice, as noted previously, is the staple food source for the Malagasy people. The comparison between *Bazary Kely* rice merchants and Andasibe rural farmers yields two different schemas of rice. The basis of the merchant's rice schema is the appearance of the grain, whereas the basis of the farmer's rice schema is upon rice plant characteristics. The schemas are dissimilar to each other as merchants and farmers require different knowledge to pursue their livelihood, the selling and growing rice respectively. A comprehensive understanding of rice schemas is necessary for an understanding of the cultural model of *tavy,* as rice plays an integral part in the ritual process as a symbol and is the product that the rituals are attempting to bring, a bountiful rice crop. In addition, the practical information of customer choices aids in an understanding of the effects of the development of genetically engineers rice varieties.

7.1. *Bazary Kely* Rice Merchants

Bazary Kely (small market) is one of two large open markets in Toamasina, the eastern provincial capital. There are fifty-two merchants who specialize in selling rice and are categorized by their location and amount of rice sold. The merchants that are next to the road, the outside of the market, often sell greater quantities of rice, as access is easier for restaurants and hotels to place fifty kilos sacks of rice in vehicles or a *pousse-pousse* (rickshaw). The rice merchants within the market tend to specialize in rice for different regions and their customers are usually households with only the occasional buyer purchasing more than two kilos of rice at one time.

The knowledge of rice varieties is dependent upon whether the merchant has ever farmed rice. Those that have farmed know a greater variety of specific rice types (e.g.,

Betahavana, *Vary Betanety*, *Vary Bodofotsy*, *Vary Mamoriaka*, and *Vary Tsimaory*). The former farmers know more rice varieties as the schema for farmers includes plant varieties and rice kernels are the basis of the schema for rice sellers. The following discussion of rice types known by merchants in *Bazary Kely* only reports those types of rice that are commonly known to all of the rice sellers. There are seven rice varieties (see Figure 7.1) commonly known as rice types by the rice merchants in *Bazary Kely* (*Chine*, *Makalioka Fotsy*, *Makalioka Mena*, *Pakistan*, *Rojo Mena*, *Tsipala* and *Vary Kitra*). The first dimension of contrast between rice varieties is *Stok* and *Vary Gasy* *Stok* is a category of old rice that when cooked is dehydrated so increases in volume more than fresh (*Vary Gasy*) rice. *Stok* is less expensive (2,200 FMg per kilo average) than *Vary Gasy* (2,500 FMg per kilo average). The preferred type of rice, for those customers that can afford it, is *Vary Gasy*. The rice merchants and buyers believe that *Vary* tastes better and is better for one's health, because it contains more vitamins. The merchants stated that the poor usually buy half *Stok* and half *Vary Gasy* and mix the two types when cooking meals. Only the poorest of their customers buy *Stok*, as the strong preference for local rice results in all other customers buying *Vary Gasy*.

Three varieties of Stok (see Table 7.1) are known by all rice merchants in *Bazary Kely* (*Vary Kitra, Chine,* and *Pakistan*). *Vary Kitra* is dried local rice due to the length of time that it has remained in the store. This type of rice is the least in demand by customers. The other two types of *Stok* are *Chine* and *Pakistan*, both of which are imported. Merchants believe that *importe* rice contains chemicals, which prevents rats and other pests to eat the rice while en route to Madagascar. It is a common belief that these chemicals are unhealthy, especially for children. This belief, that *importe* is not

healthy, was also echoed by other Malagasy that were spoken with who did not sell rice. Several of the merchants reported that *importe* tasted of chemicals, which has a displeasing taste.

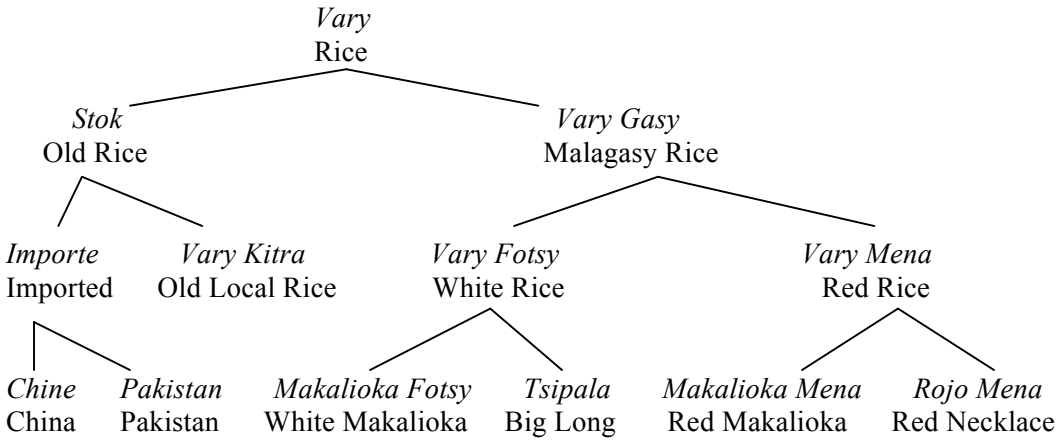


Figure 7.1. *Bazary Kely* merchant taxonomy of commonly known rice types.

There are four varieties of *Vary Gasy* commonly known by the rice merchants in *Bazary Kely* (*Makalioka Fotsy, Tsipala, Makalioka Mena* and *Rojo Mena*). The differentiation of these four varieties is by the color of the rice kernel (white - *Makalioka Fotsy* and *Tsipala*; red - *Makalioka Mena* and *Rojo Mena*). Merchants report that both Makalioka varieties are the same kind of rice, the only difference being the color of the rice kernel. The main differences between *Makalioka Fotsy* and *Tsipala* are that the *Makalioka Fotsy* kernel is thick and cloudy white, while the *Tsipala* kernel is thin and transparent. With the red varieties of *Vary Gasy*, *Makalioka Mena* and *Rojo Mena*, the difference lies in that *Makalioka Mena* is long grain rice and *Rojo Mena* is short grain rice. The location where the rice is grown and the method of processing is a determinant in the presence or absences of stones. The method of removing rice from the husk in both Antananarivo and Ambatondrazaka by winnowing on the ground, whereas in other areas farmers use baskets to winnow rice. Among the rice varieties sold in *Bazary Kely*,

Tsipala, *Makalioka Fotsy* and *Vary Kitra* are the only one from this area (Ambatondrazaka). The merchants reported that customers prefer rice that does not have stones, as it is hard on one's teeth. Among all varieties of rice sold by the merchants in *Bazary Kely*, customers prefer the local red rice and it is the most expensive (2,800 FMg per kilo average).

Table 7.1. *Bazary Kely* Merchant Rice Categories

	Chine	Makalioka Fotsy	Makalioka Mena	Pakistan	Rojo Mena	Tsipala	Vary Kitra
Age	old	fresh	fresh	old	fresh	fresh	old
Chemicals	yes	no	no	yes	no	no	no
Color	white	white	red	white	red	white	any
Length	short	short	long	long	short	long	any
Location(s)	11	1, 4 and 6	4	11	4	1	1 to 10
Smell	no	yes	yes	no	yes	yes	no
Stones	no	maybe	yes	no	yes	no	maybe
Taste	no	yes	yes	no	yes	yes	yes
Transparent	no	no	no	no	no	yes	no
Width	thick	thick	thin	thin	thick	thin	any

(Locations: 1 Ambatondrazaka, 2 Ambositra, 3 Antsirabe, 4 Antananarivo, 5 Ambatolampy, 6 Tsiraomandidy, 7 Maroantsetra, 8 Fenoarivo-Est, 9 Toamasina II, 10 Vavatenina and 11 Imported)

The schema of rice held by the rice merchants reflects the specific knowledge that they must have to sell rice to customers. Upon arriving at the merchant's store, the customer will first examine what rice varieties the store is selling (noted by cardboard or paper signs written with the rice name and price affixed or placed within each basket holding rice). Picking up a handful of rice and examining its quality is a way for a customer to express further interest in a particular variety. The customer may also smell the rice. Factors that effect the quality of the rice beyond that already covered in the schema is the percent of rice grains broken, location in which the rice was grown and amount of rice husk still in the rice. None of these qualities is dependent upon the rice type, but how it was processed (e.g., machine and/or by hand).

It is by knowing and understanding the schema of rice types, that a rice merchant can be successful in presenting their rice for customer's needs and/or wants. The merchants must have a variety of rice types in their shop so that they can cater to each socio-economic class, for example, the 'upper class' wants *Makalioka Mena* and *Rojo Mena* and the 'lower class' needs inexpensive *stok*. However, if the prices were equal between the rice types, the merchants reported that *Makalioka Mena* and *Rojo Mena* would be preferred as they are both fresh, have no chemicals, are red, smell good, do not have stones and have a pleasant taste. The importance of this choice is that FO.FI.FA, in it's pursuit of increasing rice yields, states openly that it does not matter what the rice looks like, as long as the crop yields increase, the farmers, merchants and consumers will be pleased. This assumption by FOFIFA is clearly false. To increase the likelihood that the Malagasy accept a genetically engineered rice variety, it should fall within the characteristics of *Vary Mena* (red with long and thin grain) which is the preferred variety by the Malagasy in Toamasina.

7.2. Andasibe Farmers

The knowledge of *tavy* rice varieties of Andasibe's rural farmers follows a schema that is quite different from that of the rice merchants in *Bazary Kely*. The first difference between the two schemas is the number or rice varieties known. The rice merchants commonly know six varieties of rice and the farmers know sixteen, nearly three times as many. In addition, of the merchants that claimed to know additional types of rice other than the basic seven varieties, only those that had farming experience knew more than two additional types. The Andasibe farmers that knew more varieties other than the basic sixteen types, claimed to have knowledge of more than four different types

up to a maximum of twenty-one types. These other types were known to other farmers, but they claimed that these additional types were grown in other regions of Madagascar and only the types described below did well in Andasibe's high altitude, high humidity and low temperatures.

The second difference between the schemas of rice by the merchants and farmers is that the merchants base their schema of rice upon the rice kernels, whereas the farmers base theirs on plant characteristics. The schema of *tavy* rice varieties for the farmer allows them to know what type of rice is growing in their field so that the time of harvest can be determined. In addition, the different varieties of rice plants appears to require different times of planting, but the farmers interviewed could not agree to which varieties should be planted at what time. From interviews, it also appears that the type of rice used for seed is not always identifiable as to what type of rice plant will be grown. The farmers claimed that a round grained rice kernel will likely result in a round grained product, but other than shape, the farmers could not be sure what type of rice was being grown until the plant begins to grow. The farmers reported that they used whatever seed was available for planting, which was usually rice saved for this purpose from the last crop grown.

Informants claimed that the most important attribute of rice towards its identification was the stalk base color. The stalk base color is the color of the rice plant at the base's intersection with the ground. Rice plant types vary in stalk base color from dark reddish brown to light whitish green. However, there are only three different color variations and sixteen types of rice. Therefore, base color, by itself, cannot allow a farmer to determine exactly what type of rice plant it is.

The second most important quality of rice plants used for their identification is the kernel skin color. The variations possible are white, red and black. The color of the kernel skin is especially important as the color can influence the amount of time that the farmer must spend protecting the rice plants from pests. The black variety is of interest as the farmers claim that the black kernel skin color of the *salazana* rice variety protects the kernels from becoming food for the *fody* (Madagascar Fody, *Foudia madagascariensis*), an indigenous sparrow that frequents rice fields and is a pest species. The farmers spend countless hours guarding their rice fields from the *fody* with stones thrown with slings. The farmers stated that the *fody* does not know that the black seeds contain rice and do not consume them.

Table 7.2. Farmer *Tavy* Rice Categories (Part 1)

Name	Kernel Color(s)	Growth Period	Stalk Base Color
Belohalitra	white	6 months	dark reddish brown
Bodoravina	white	6 months	dark reddish brown
Botrafotsy	white	6 months	light whitish green
Botramitso	white/red	6 months	green
Kely Randro	white	5 months	light whitish green
Langaka Fotsy	white	6 months	light whitish green
Langaka Mena	red	6 months	dark reddish brown
Loambitro Botsa	white/red	6 months	light whitish green
Loambitro Malady	white/red	5 months	light whitish green
Mananelatra	white	5 months	light whitish green
Menalava	white	6 months	light whitish green
Salazana	white	6 months	dark reddish brown
Sihanika	white	5 months	light whitish green
Soamitso	white/red	4 months	dark reddish brown
Somboyra	white/red	5 months	light whitish green
Vonjy (Brazil)[6]	white/red	4 months	green

The next most important characteristics towards determining the variety of rice is

[6] Farmers believe this type originated in Brazil, hence its alternate name.

the kernel shape, color and plant height. The length and width of a kernel determined the basic shapes of rice, which may or may not include a beard. The beard is a string of fiber of varying length attached to the rice kernel. Most of the rice varieties produce white kernels (9 variations), followed by either bicolor (6 variations) and only one variety produces exclusively red rice kernels. The height of rice plants varies from 25 centimeters to 175 centimeters. This aspect is important as the only difference between *loambitro botsa* and *loambitro malady* is the plant height. These names of rice illustrate difference between these two by the fact the shorter variety of *loambitro* is termed *malady*, which translates as "quick." In general, the plants that have a shorter growth period before harvest are also those that do not grow tall. The farmers did not express a preference for those types that grew faster, but instead were concerned with the quality and amount of the kernels produced.

Table 7.3. Farmer *Tavy* Rice Categories (Part 2)

Name	Kernel Skin Color	Kernel Shape	Plant Height
Belohalitra	white	short grain	100 to 175 centimeters
Bodoravina	white	short grain	100 to 125 centimeters
Botrafotsy	white	round	75 to 100 centimeters
Botramitso	white	round	100 to 125 centimeters
Kely Randro	white	short grain	100 to 125 centimeters
Langaka Fotsy	white	short grain	100 centimeters
Langaka Mena	red	short grain	100 to 175 centimeters
Loambitro Botsa	white	short grain	50 to 75 centimeters
Loambitro Malady	white	short grain	25 to 50 centimeters
Mananelatra	white	short grain	50 to 75 centimeters
Menalava	white	short grain	100 to 175 centimeters
Salazana	black	short grain	100 to 175 centimeters
Sihanika	white	short beard/round	75 to 100 centimeters
Soamitso	white	short grain	50 to 75 centimeters
Somboyra	white	long beard/short	100 to 125 centimeters
Vonjy (Brazil)	white	short-fat grain	25 to 50 centimeters

The schema of *tavy* rice varieties described above is important for rice farmers as the knowledge of what types of rice are being grown indicate time of the harvest. If a farmer does not harvest rice at the optimal time, the *fody*, rats or other pests may eat the rice in the field and thereby lower the crop yield. The landscape of Andasibe is dotted by several farms that have failed. The farmers reported that these families have left, as they did not have any success in farming due to poor land, the lack of attention to the spirits who inhabit the land and/or the lack of knowledge of rice types that grow in the Andasibe area. Being that most, if not all, of the farmers in the Andasibe region are living perilously close to starvation, a failed crop will be disastrous for the farmer and his family.

7.3. Conclusion

For the merchants, *Makalioka Mena* and *Rojo Mena* variety preference by customers illuminates the need for red varieties of genetically engineered rice, rather than the white types in development by FOFIFA. In the case of the farmers, *Salazana*, which has a black kernel skin color not recognized by the *fody*, may also lead to the development of a rice variety the could show pest resistance and increase crop yields without the use of pesticides if shown empirically. In both of these instances, knowledge of local Malagasy about rice could and should be used by organizations attempting to increase crop yields to increase the likelihood of success and acceptance by the Malagasy people. The merchants must know the qualities of the rice grains that satisfy the customers and the farmers must know the different types of rice plants so they know when the rice is ready to harvest. The only common trait of rice that is present in both the merchant and farmer's rice schemas is rice kernel color.

Chapter 8. Agricultural Rituals

The agricultural rituals practiced during *tavy* enable to farmer to assure that harm does not befall him and that the resulting crop will be bountiful. This chapter begins by a description of the rituals performed by rural farmers as they do *tavy*. Next, a discussion of the rituals involved with *tanimbary* (irrigated rice field) is described, with an emphasis on those beliefs affected by a development program. Then, there is a discussion of the variation of the culture model of *tavy*. Finally, there is a discussion of the implications for the cultural model of *tavy* towards agricultural development in eastern Madagascar.

8.1. Tavy Rituals

During six months of fieldwork in early 2003, 54 farmers from three localities within eastern Madagascar participated in interviews designed to elicit what rituals are associated with *tavy*; their cultural model of *tavy*. My goal was to understand the impact of agricultural change on local beliefs. Four distinct ritual schemas emerged from the interviews, one for each of the four stages of the swidden cycle for which rituals are performed. There are four periods during *tavy* that rituals are performed, cutting, burning, planting and harvesting. Each of the rituals seeks to implore a supernatural entity to effect change, god (*Andriamanitra*), the ancestors (*razana*) or natural spirits who live on the land (*zanahary*). There was much variation in what the farmer offered to the intended entity of the ritual. The following description of the ritual schemas of *tavy* is written as and overview without regard to the variation between farmers in their beliefs, which are analyzed in detail later in this chapter.

8.1.1. Offerings

Each of the farmers interviewed stated that they performed all of these rituals, but

the offerings given at each ritual varied. The five items most commonly offered are *vary fotsy* (cooked white rice), *masomboly* (seed reserved to be sown), *tantely* (honey), *toaka-Gasy* (distilled rum made with sugar cane) and *betsabetsa* (fermented beer from rice and honey). *Vary fotsy* is literally translated as white rice, but, in rituals, can be any type of rice. Rice was the food of the first Malagasy and forms a pact with the spirits so that no harm will come to the farmer. *Masomboly* represents fertility or the potential for fertility. Farmers use *tantely* to bring something good. The sweetness of the honey represents goodness of harvest and/or body. The ancestors and other spirits understand honey, as it is natural and was available to the ancestors when they were alive in comparison with refined sugar, which is a more recent creation. *Toaka-Gasy* is a distilled alcohol made with sugar cane. Many of the farmers believe that *toaka-Gasy* is not clean because the process of making *toaka-gasy* includes mashing the cane fibers with the feet, which are dirty. Some of the informants stated that impure things offend the ancestors and other spirits. *Betsabetsa* is beer fermented from rice and honey. The process of making *betsabetsa* by hand and is believed to be cleaner than *toaka-Gasy*. Many of the farmers also reported that because *betsabetsa* includes honey as an ingredient, *betsabetsa* could represent health in addition to its other properties. The ancestors prefer *betsabetsa* because the ancestors know *betsabetsa,* as they had it when they were alive.

With each of the rituals, the entity is prayed to and offerings are made on *ravinala* (travelers palm - *Ravinala madagascariensis*) leafs placed in the northeast corner of the plot, either on the ground or a platform (usually a tree stump). The choice of *ravinala* is not ritually significant, but is practical as it is common and has large leaves, which can serve as a place for offerings. The cardinal location of the offering is important. The

east, for the Betsimisaraka, symbolizes life, as it is where the sun rises. The west symbolizes death, as the place where the sun sets. The north symbolizes the location from which the ancestors came to Madagascar and the south the location from where sorcerers came. The northeast direction the both symbolizes life and the ancestors, which is believed to promote the likelihood the ritual will be well received by the spiritual being it is aimed.

8.1.2. Cutting

The first of these ritual schemas occurs before the farmer cuts vegetation on the plot of land that is for *tavy*. This ritual attempts to implore the *zanahary*, naturally occurring spirits that live on the land, to protect the farmer and other workers from injury, especially as injury from the *angady* (bush knife). An *angady* is made from a six to eight inch steel blade attached to wooden handle, which is usually around two feet long. After the most commonly offered items (*vary fotsy* and *tantely*) are placed on *ravinala* leaves in the northeast corner of the plot and a prayer is said to the *zanahary*. The farmer prays aloud and, according to one informant, the prayer is the following:

> Come *zanahary*.
> Here is your *vary fotsy* and *tantely*.
> These are for you, *zanahary*.
> Take and eat them.
> Then go and leave me to work.
> Leave this place and go somewhere else.
> Leave here so I do not get hurt
> Leave here so I am not cut.
> Leave here.

During the prayer, one informant stated that she would make motions with her hands to indicate the location of the offerings and to put the offerings in her mouth. Once the ritual is complete, the farmer leaves the offerings for the *zanahary* and cutting begins.

8.1.3. Burning

The second ritual schema occurs before burning the dried vegetation, which farmers believe fertilize the field. During this ritual, the farmers are asking *Andriamanitra* (god) to protect the farmer from the fire and prevent the fire from spreading beyond the intended *tavy* field. Several of the farmers told stories of fires that burned out of control and harmed family members. In addition, stories abounded of fires that the farmer designed to burn two or three hectares spreading to destroy over one hundred hectares of vegetation. If the farmer performs this ritual properly, farmers prevent such events, and conversely, when a fire gets out of control, farmers believe that the ritual was improperly done or they did not have acceptable offerings. As with the prior ritual before cutting, the offerings (usually *vary fotsy*, *tantely* and *toaka-Gasy*) are placed on *ravinala* leaves in the northeast corner and a prayer is said.

8.1.4. Planting

The third ritual schema, which contains two subschemas, occurs before planting rice seeds on the *tavy* field. The farmer will address both *Andriamanitra* and the *razana*. The farmer asks *Andriamanitra*, who has control over the physical environment of field such as weather, soil and water, to ensure a good crop and prevent heavy rainfalls that would erode topsoil. While the *razana* are ancestors, they are not necessarily the direct ancestors of the farmers, but prior inhabitants that own the land and may or may not be a relation to the farmers, as different ancestors inhabit different parcels of land and may have different personalities that may affect the choice of offerings. The ancestors have the power to pass on the requests of the farmers to *Andriamanitra* to ensure that the crop is successful. As with the prior rituals, the offerings (usually *vary fotsy*, *masomboly*,

tantely and *toaka-Gasy*) are placed on *ravinala* leaves in the northwest corner and a prayer is said.

8.1.5. Harvesting

The fourth and final ritual schema is *lango*, the first rice ritual. Before the farmer harvests the main crop, the farmer takes six heads of rice from the field. The number six is a magically significant number, which represents good for the Malagasy. None of the informants could identify a common reason that the number six was good. The farmer dries the rice over a fire or by hanging the rice in his house. After drying the heads of rice, the farmer removes the kernels from the husk by placing them in a bag and beating them with a stick. The next step is to cook the rice in a pot over a fire. This rice, along with other offerings (most often *tantely* and either *toaka-Gasy* or *betsabetsa*) are taken to the *Tangalamena* (elder who ensures people properly adhere to the customs), who then prays over the offering to *Andriamanitra* to remove the *tsiny* (bad spiritual powers/sin) so that the farmers may harvest the rice and bring it to their home, thereby bringing the health of the field into their home.

Each of these four ritual schemas have commonalities, in that they contain a prayer followed by offerings to a spirit. While all but the last ritual, *lango*, may be performed by an individual, members of the farmers family and community participate in the *lango* ritual. For example, before cutting, usually the nuclear family is present and often members of the extended family assist with the work in the field. Therefore, while the farmer performs the ceremony, others participate by observation. In this way, the older generation teaches *tavy* ritual schemas to the younger members of the family and often extended family member share similarities in how they choose to perform the

rituals.

8.2. Tanim-bary Rituals

In June and July 2004, interviews conducted in and around Andasibe with members of the *Betsimisaraka* on the rituals associated with *tavy* (swidden rice agriculture) discovered that there are similar rituals done when the farmers are pursuing *tanimbary*. The purposes of rituals with *tavy* and *tanimbary* are the same, to ensure a successful rice crop and protect the farmer and his family from harm. There is variation in what farmers reported as the correct rituals for *tanimbary*. Much of this variation correlates to the landscape's properties (e.g., "dry" land and "wet" land). What follows is a discussion of the most common responses from the farmers regarding rituals performed during *tanimbary* and concludes with a short discussion of the relevance of these findings for agricultural development in the Andasibe region of Madagascar.

8.2.1. Forests verses Grasslands

When farmers discuss the rituals that they perform during *tanimbary*, they begin by describing the differences with rituals performed during *tavy* and *tanimbary*. The first distinction that was made by the farmers was the difference between why the rituals were different between *tavy* and *tanimbary*. As one farmer explained, "*tavy* is done in the forest and *tanimbary* is only done where there is grass and no trees." In areas where there are no trees and only grass, there are no plants that contain spiritual powers that can harm the farmer and/or his family. In forests, two plants (*ranalahy* [deer antler fern] and *vahimifehy* [knotted vine]) have specific spiritual properties that can result in illness or death of the farmer or one of his family members. The farmers believe that *ranalahy* houses deceased animal spirits. None of the informants, including the *mpanandro* (healer

and diviner), knew how the animal spirits came to inhabit the *ranalahy*, but all knew that if this plant is cut down in preparation for agriculture, the result can be illness of the farmer or his family. *Vahimifehy* can be any knotted vine and the farmers believe *vahimifehy* to contain the spiritual power of *Andriamanitra*. According to an *mpanandro* in the Andasibe region, if this vine is cut or not respected (e.g., shaking or hitting the vine), the farmer can become violently ill and may die within minutes. In either case, if one of these plants is disturbed the farmer must pray and offer the following items on *ravinala* or another broad leafed plant (e.g., *akondro* [banana] or *longoza* [wild ginger]) to appease the spirit: *tantely* and *vary fotsy*. Since *tanimbary* locations do not contain either of these species of spirit housing plants, rituals do not need to be preformed that appease the spirits contained within them. The main difference between the two types of agriculture appears to be that *tavy* contains more varied and complicated rituals than *tanimbary* since there are more spiritual plants in forests than grasslands.

8.2.2. Ecotypes

There is a further category of *tanimbary* by farmer's differentiation of the land into two separate ecotypes of "dry" (e.g., valleys and flat fields) and "wet" (e.g., marshes) land. The farmers believe that both "dry" and "wet" land areas share similar spiritual properties. In both "dry" and "wet" land, the farmers reported that they pray to *Andriamanitra* for a good harvest and enough rain. In addition, the *zanahary* may inhabit both area types. The farmers make prayers and offerings to the *zanahary* to ensure that the farmer does not become ill or injured while farming that location. Farmers commonly report to use the following offerings: *tantely* or *siramamy* (sugar), *vary fotsy* and some type of alcohol (e.g., *toaka-gasy*, *betsabetsa* or another alcohol that happens to

be on hand).

While "dry" and "wet" land share some common spiritual characteristics, they also have distinctive spiritual features that require specific rituals. "Dry" land is the location in which the *razana* are the occupants and owners of the land. To pursue any form of agriculture on dry land, the farmer must pray and make offerings to the *razana*. The offerings that farmers commonly reported included the same as those used for the *zanahary*. Before digging any irrigation canals, the farmer will place some or all of the aforementioned offerings on a broad leaf and pray to the *razana*. The "dry" land is also the potential home of *vazimba* (spirits from god, but less powerful than the *zanahary*). The *vazimba* naturally occur in the water, but those who have moved to inhabit "dry" land are more powerful and can cause much harm to the farmer and his family. The *vazimba* on "dry" land have tools such as mirrors and knowledge of *fanafody* (Malagasy medicine), which are the same tools by which an *mpanandro* may counter the effects of spiritual imbalance. Therefore, the *vazimba* are difficult for the *mpanandro's* magic to counter. *Vazimba* on "dry" land use mirrors and *fanafody* to communicate with and affect humans. If a farmer does something that is *fady* on their land, such as defecating, they can kill him in seconds. If the farmer believes that "dry" land *vazimba* inhabit a parcel of land that the farmer wishes to use, he will consult with the *mpanandro* to receive instructions and *fanafody* to remove the spirit from that location.

In direct contrast to "dry" areas, "wet" areas are the natural habitat of the *vazimba.* The usual offerings that the farmers give to the *zanahary* and *razana* suffice to ensure that the farmer does not become ill. None of the farmers claimed to pray and make offerings to the "wet" land *vazimba* when farming "wet" areas, but another spiritual

force does require special care. Several female informants explained that if a child dies before it is one year old or by miscarriage, the mothers bury the infant's linen wrapped body in a marsh. The informants and *mpanandro* explained that the reason for this type of burial is so that the mother remains "wet" (fertile). If the infant is buried in a coffin on "dry" land, as custom dictates for adults and children over one year old, the woman will become "dry" (infertile) and not able to bear any more children. The degree of moisture of the infant's burial place correlates to the ability for women to bear children. The importance of this burial rite for agriculture is that no farmer in the Andasibe area will knowingly pursue *tanimbary* in one of the four marshes used to bury infants because they may become ill and their crops likely fail due to the malicious infant spirits. For example, one informant stated that an immigrant farmer who attempted to grow rice on one of the burial marshes. The farmer and his wife became ill and only twenty percent of their crop succeeded. Both the man and his wife sought the help of the *mpanandro* who gave them *fanafody* that restored their health, but their crop was almost entirely lost.

The farmer performs all of the aforementioned rituals before digging the irrigation canals for the *tanimbary*. In addition, about one-half of the farmers perform rituals only the first time the area was prepared for *tanimbary*. The other farmers stated that the rituals occur each time the land was prepared for *tanimbary*. Two informants related that the farmer might need to make special offerings to specific ancestors of that particular area. Neither of the informants was able to explain how they came to know what the individual ancestor spirits liked, but did report offering coffee and/or tobacco on several occasions.

8.3. Intracultural Variation

The data were analyzed for informant agreement using principal component analysis (PCA) and general linear models (GLM) (in part after Romney, Weller, and Batchelder 1986). While Romney, et. al. (1986) used minimal residual factor analysis (MRFA), PCA was used for this analysis as both analyses appear to have similar results. The results of the analysis on the entire sample, Betsimisaraka and each sample area are shown in Table 8.1. The resulting factor plot (first against second factor scores of informants) reveals the pattern of variation among informants by two variables, community and percentage of total rituals the informant reported done (see Figure 8.1). When isolated in the factor plot, the three communities (Andasibe, Mahatsara and Ampangalatsary) show that there is a tighter grouping of both the Mahatsara and Ampangalatsary samples than with the Andasibe sample. Both a t-test and GLM analysis were completed to show that community is related to the second factor (t -13.210, f 48.282, $p < 0.001$). In addition to community being an explanatory variable of the variation in agreement among informants, the percentage of total rituals reported to be done by each informant shows a pattern corresponding to the second factor (t -23.187, f 35.393, $p < 0.001$). One way to show these complex relationships is through Figure 8.1, which shows the spatial relationship between ritual knowledge and location.

Table 8.1. Intercultural Variation - Principal Components Analysis

Sample Group	N	Variance Explained by 1st Factor	Ratio Between the 1st and 2nd Eigenvalues
All	185	40.18%	3.3:1
Betsimisaraka	149	40.05%	3.4:1
Betsimisaraka in Andasibe	50	49.44%	3.4:1
Betsimisaraka in Mahatsara	49	42.41%	3.8:1
Betsimisaraka in Ampangalatsary	50	47.08%	4.3:1

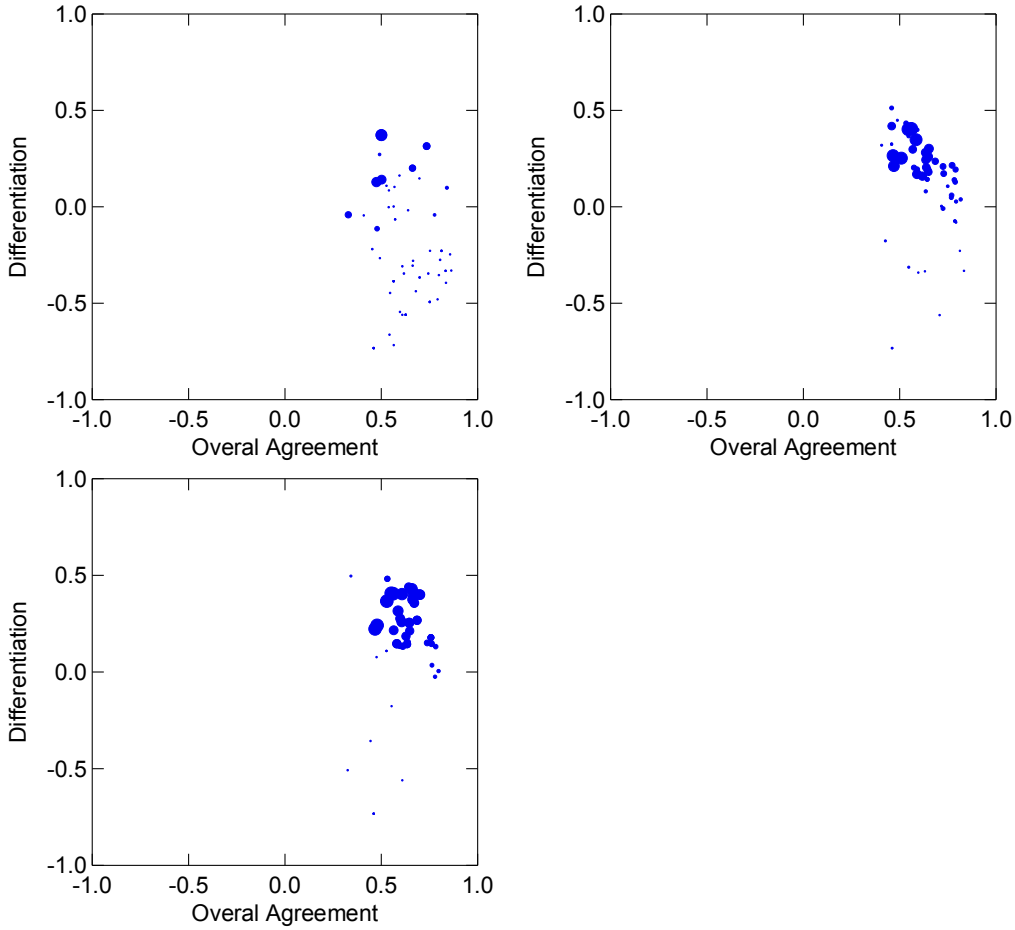


Figure 8.1. Scatter plots of the first factor (overall agreement) and second factor (differentiation) resulting from the principal components analysis of each sample (Andasibe upper-left, Mahatsara upper-right and Ampangalatsary lower-left). The size of each informant point represents the percentage of total rituals performed (30% to 80%, larger points represent larger percentages).

The variation on the second factor shows that the percentage of rituals known relates to the location in which the informants live, but does not explain the degree of conservation influence on knowledge (see Figure 8.1). The next step was to analyze the data collected on the number of conservation organizations in each community sample (Andasibe 7, Mahatsara 3 and Ampangalatsary 1). Using a simple Pearson's correlation, the relationship between the percentage of *tavy* rituals known and the number of conservation organizations in the area are negatively correlated (r -0.585, $p < 0.001$).

Assuming that the conservation organizations active within each area are having an equal effect in their education programs, the hypothesis, as knowledge of non-indigenous conservation practices increases, knowledge of *tavy* decreases, is accepted.

8.4. Hypothesis Testing

The agreement among informants and hypothesis testing results help explain the cultural variation in knowledge among informants, but the particular differences in knowledge are attained only through a detailed examination of each item that constructs the cultural model of *tavy*. To itemize the difference in ritual knowledge, the first step was to change the cultural model data from rating on a four-point scale to binary data so that the data would represent the farmer's reported correct practice of the item, rather than strength of what the farmer reported (e.g., strong and mild agreement as 1; strong and mild disagreement as 0). From this data, calculations were made of sample means and resulting percentages for each individual response. Next, the data were consolidated from each informant percentages as a whole and by community (Andasibe, Mantadia and Ampangalatsary), as well as, by prayers and individual offerings (see Table 8.2). In other words, the data is a summary of each practice across the five rituals, so each prayer variable is from the five rituals and combined into one composite variable of prayer (see Table 8.3).

Table 8.2. Tavy Ritual Variation

Ritual Schema (entity)	Item	All	Andasibe	Mahatsara	Ampangalatsary
Cutting (*Zanahary*)	*Pray*	70%	36%	85%	95%
	Vary Fotsy	50%	9%	64%	82%
	Masomboly	0%	0%	0%	0%
	Tantely	58%	12%	78%	90%
	Toaka-Gasy	1%	0%	0%	3%
	Betsabetsa	1%	2%	0%	2%
Burning (*Andriamanitra*)	*Pray*	78.%	68%	78%	90%
	Vary Fotsy	27%	5%	31%	48%
	Masomboly	0%	0%	0%	0%
	Tantely	28%	8%	39%	38%
	Toaka-Gasy	26%	14%	25%	40%
	Betsabetsa	7%	2%	8%	10%
Planting (*Razana*)	*Pray*	76%	61%	83%	87%
	Vary Fotsy	40%	11%	47%	65%
	Masomboly	35%	14%	34%	62%
	Tantely	42%	20%	39%	68%
	Toaka-Gasy	25%	5%	29%	45%
	Betsabetsa	14%	2%	14%	28%
Planting (*Andriamanitra*)	*Pray*	80%	77%	80%	83%
	Vary Fotsy	30%	8%	32%	53%
	Masomboly	29%	11%	29%	50%
	Tantely	33%	12%	32%	57%
	Toaka-Gasy	1%	3%	0%	0%
	Betsabetsa	17%	2%	13%	38%
Harvesting (*Andriamanitra*)	*Pray*	22%	5%	27%	35%
	Vary Fotsy	46%	21%	51%	68%
	Masomboly	0%	0%	0%	0%
	Tantely	10%	3%	12%	17%
	Toaka-Gasy	9%	3%	12%	13%
	Betsabetsa	11%	3%	12%	18%

Table 8.3. Tavy Ritual Variation (Composite Variables)

Item	All	Andasibe	Mahatsara	Ampangalatsary
Prayer	74%	64%	78%	81%
Offer *Vary Fotsy*	54%	33%	58%	72%
Offer *Masomboly*	35%	28%	34%	41%
Offer *Tantely*	50%	33%	54%	63%
Offer *Toaka-Gasy*	32%	27%	32%	39%
Offer *Betsabetsa*	35%	30%	35%	39%
Total	47%	36%	49%	56%

In many of the items, there is little or no difference in the responses of the informants (e.g., when cutting all informants do not offer *masomboly* to the *zanahary*; see Table 2). However, in other items, there is a significant difference in the responses of the informants (e.g., when cutting one offers *tantely* to the *zanahary* – Andasibe 12.12%, Mahatsara 77.97% and Ampangalatsary 90.00%). Whether there is little or great variation among the individual items listed in Table 3, a general trend correlates with the amount of active conservation organizations. In Table 3, the trend is more obvious as Andasibe has the lowest percentage of respondents knowing the use of the item across rituals and Ampangalatsary informants having the highest percentage of informant responding that they knew the item.

8.5. Discussion

The cultural model of *tavy*, as demonstrated by the principal components analysis, is a shared set of knowledge. When asked why he responded to the questions differently than his three close friends, the informant stated that he had learned what he knows from his parents and his friends learned what they know from their own parents. Another informant stated that she does not speak to other farmers about the rituals or anything else to do with farming. It appears from these statements and the results of the analysis that a better understanding of the sharedness of ritual knowledge would include an analysis of kinship relatedness, but kinship relationships were not collected.

The analysis has not falsified the hypothesis that as knowledge of non-indigenous conservation practices increases, knowledge of *tavy* decreases. The difference found was a measure of conservation organization education by number of conservation organizations in the sample areas. The numbers used (Andasibe 7, Mahatsara 3 and

Ampangalatsary 1) may represent another phenomena that explains the amount of *tavy* ritual knowledge (e.g., the degree of urbanity, social control, and/or population density). A simplified and perhaps clearer way to analyze the variation between the three communities is by a simple ANOVA between the amount of ritual performed and the location of the informant. The results of the ANOVA analysis show there is a significant difference between the three communities (F 22.41, P > .001, see figure 8.4). A valid measure of the effects of conservation organizations will entail determination of the discrete items of information that the conservation organizations are teaching and then testing for those items among the farmers.

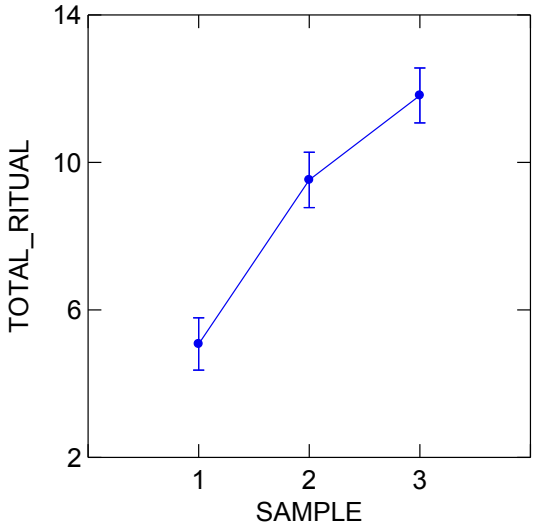


Figure 8.4. Least squares means plot from ANOVA between total rituals performed and sample populations (Andasibe 1, Mahatsara 2 and Ampangalatsary 3).

Are the farmers who had more knowledge regarding *tavy* rituals better than those who may know the correct answer? By returning to the principal components analysis, one can ascertain what the correct answer may be examining the scores on the first factor. These scores not only represent the overall agreement, but a high score on the first factor also represents informant's high agreement with others. Using a simple Pearson's

correlation, it is evident that there is no relationship between overall agreement (first factor score) and degree of conservation influence (r -0.080, P > .05). It is difficult to reason that more ritual knowledge is correct in light of how informants answered why one would use *betsabetsa* instead of *toaka-Gasy*. Some informants stated that the ancestors understood *betsabetsa*, whereas *toaka-Gasy* could upset the ancestors. Other informants stated that any alcohol was appropriate, as the important quality of the offering was the alcohol content. In light of this information, does a loss of cultural knowledge represent knowledge of the use of one over the other, knowledge of using both or knowledge of none? Returning to the data, whether differences in the response to which alcohol used in *tavy* may affect the results of variation in the sample. When alcohol, both *betsabetsa* and *toaka-gasy*, is combined as one variable, the results show that there is less sharing (ratio between the 1st and 2nd eigenvalues, 3:1). It is clear that the cultural knowledge of *tavy* is more complex than a summative rendition of cultural knowledge.

Data analysis is also difficult because of the attempt to measure culture change at one point in time across three communities, rather than following one community over time. It would have been better to have an assessment of the variation in *tavy* ritual knowledge before conservation organizations began educational program in the area so one could compare before and after the effect conservation organizations have had on the farmers. It could have been determined, for instance, whether the discrepancy between *betsabetsa* and *toaka-Gasy* was a result of something other than conservation organization influence. In addition, it could be determined if more ritual knowledge or different ritual knowledge was the better estimation of conservation organization

influence. However, this historical information is not available and the current data may serve as a beginning of a measurement datum for future analyses.

While there are significant issues that have arisen during this research that prevent a clear understanding of the effects that conservation organizations have on indigenous knowledge, the cultural variation between these three sample populations provides opportunities for further research are identified. The approach to the study of cultural models through quantitative methods allows the measurement of variation in belief. The stark difference between the three sample populations would not be known without quantitative methods used in this analysis. The variation in knowledge was not correlated with any of the demographic information gathered[7] other than sample location. Further research into how the conservation organizations are attempting to introduce change and the social-cultural methods of knowledge transfer between families about *tavy* ought to be examined.

[7] Demographic variables: age, ethnicity, religion, years lived in the area, years farming, items grown, other supplementary occupations, irrigated agriculture experience, and last time *tavy* was performed.

Chapter 9. Conclusion

The ethnographic research and analysis presented in this dissertation has resulted in several findings. First, the culture of *tavy* and its relationship to behaviour are largely ignored by some stakeholders. *Tavy* is not only a method for growing rice, but is ritualized and contains meanings that relate to god, ancestors and other spirits that inhabit the landscape. Only one of the governmental organizations (ANGAP) recognized that *tavy* was more than an agricultural method and that it should be understood before any agricultural change is planned. The other organizations assumed that the farmers would welcome agricultural techniques that increased crop yields, regardless of how these would effect the farmer's beliefs. In addition, these organizations assume that consumers will buy white rice, ignoring the strong preference for red rice as stated by the rice merchants.

Second, rice schemas of *Bazary Kely* rice merchants and Andasibe rural farmers show that there are at least two ways that the Malagasy think about rice. The merchants know the qualities of the rice grains that satisfy the customers and the farmers know the different types of rice plants so they know when the rice is ready to harvest. The preference of red local rice may result in the rejection of white genetically engineered rice by customers. The knowledge of a rice variety that is pest resistant may add in the development of a rice variety with higher yields without the aid of pesticides.

Third, there is significant variation in the amount of *tavy* ritual knowledge possessed by the three sample populations, which appears to be related with the degree of contact with conservation organizations. One can also begin to understand the complexity of cultural knowledge and measuring such knowledge for the purposes of

development programs. One must understand ritual belief systems before attempting to replace or affect them through educational programs, but documenting the variation in beliefs is difficult. While the exact cause of the variation in *tavy* knowledge is still under question, the variation exists across the three populations and as such suggests that there must be different approaches towards any development program that relies upon education in this region of Madagascar. It is necessary that further research discover the cause of variation in the cultural model of *tavy*, be it conservation organizations or family tradition. If one learns *tavy* through the family, conservation organizations still influence knowledge and so dissemination of knowledge must be part of the analysis, especially since farmers do not communicate with each other about farming methods.

The importance for the description of agricultural rituals at length is twofold. First, the ethnographic documentation of agricultural rituals among the *Betsimisaraka* is generally lacking in anthropological literature (for one exception, see Razafiarivony 1995). Second, several institutions and agencies are currently exploring possible methods of instituting a change of agricultural practices in the eastern regions of Madagascar, but have not studied the socio-cultural consequences of such a change. These organizations's goal is to end the practice of *tavy* and introduce irrigated agricultural techniques to the area. Without an understanding of the *tanimbary* rituals, the transition will be difficult, as it is possible that marshes plowed for agriculture are not sanctified and safe to farm. If an area were prepared by heavy machinery for *tanimbary* without the benefit of adhering to the appropriate rituals, it would be refused by local farmers because of the believed presence of *zanahary*, *razana, vazimba* or infant spirits. Because these spirits have not had offerings and prayers made to them, the farmers

believe that these spirits will cause injury or death to the farmer and/or his family. The result would be that few, if any, farmers would willingly work the desecrated land. Only by a study of the ecology, economy, agriculture and ritual beliefs of the area may a development program address the issues, from the technical to the spiritual, which can enhance the probability of the success of the planned change.

There are three lessons to be learned from the current agricultural crisis in Madagascar. First, none of the farmers interviewed could explain what they would do if they were forced to halt *tavy*. Without a viable alternative, rural farmers will have no choice than to continue practicing *tavy* and continue the degradation of Madagascar's natural resources. The farmers have expressed that they are cognizant of the fact that they are rapidly coming to a juncture in which they will have to change farming techniques or no longer be able to support themselves. Already, the farmers must supplement their rice with imported rice, as their fields do not support them. The farmers see the degradation of the land, the loss of the younger generation to the cities and the need for a better way of farming; however they do not have the resources to change nor the faith in the new systems of agriculture. The farmers understand that there will be a loss of integrity of the environment if something is not done, but feel powerless to make that change. Therefore, it is not the lack of understanding of the problem that is keeping the detrimental agricultural practice in place, but a lack of resources for the shift and an identity crisis.

Second, preferences for specific types of rice will be problematic for farmers, rice sellers and consumers causing economic stress on an already stressed economy. The rice varieties engineered to produce higher yields per hectare must be appealing to the

consumer. It is not enough to produce the rice if the people will be unwilling to consume it when there are other alternatives. One cannot simply replace a practice that has significant meaning to individuals solely through technology. The advancement must not only be economically feasible, but it must be perceived as a positive addition to their life, both economically and culturally. By incorporating a study of cultural change into the larger study of finding an ecologically and economically viable solution to the issue of swidden agriculture and conservation will enhance the probability of the success of the planned change.

Finally, of all of the farmers interviewed, none acknowledge that they discussed rice farming techniques with other farmers. For example, on the outskirts of Andasibe, a farmer was asked if he spoke to other farmers about how to do *tanimbary*. He was asked this question because the appearance of his field, the fact that he was attempting to do *tanimbary* in the river and his acknowledgement that he was having difficulty suggested that he had had no instruction. In another example, a Betsileo immigrant to the Andasibe region was successfully growing rice by *tanimbary* and had an extensive vegetable garden. When asked if other farmers came to him for advice, he said that none of the local farmers had spoken with him. He was asked if he would be willing to teach others, he replied that he did not have time, but if someone were to compensate him, he would be willing to teach them his techniques. In another interview with four men, all around twenty-five years old, they each reported to know different *tavy* rituals. When asked why they each had disparate knowledge, they responded that they had learned what they know from their parents and did not discuss these differences between themselves. There is a lack of communication between farmers, which results in them often failing when they

attempt *tanimbary*. The farmers then must return to *tavy*, the method with which they are familiar and know how to be successful, at least in the short term. Without communication, either between farmers or from another organization (governmental or non governmental), farmers will not be able to transition from *tavy* to *tanimbary* on their own.

The findings of the research presented here suggest several areas of further research. First, a thorough examination of the cultural model of *tavy* in regards to how the models are shared within kinship groups to illustrate how knowledge is transmitted may be a better indicator of knowledge than influences of conservation organizations. Second, an exploration of what may be identified as a 'traditional' cultural model of *tavy* through interviews with elders in the community to more fully understand the differences between the use of *toaka-Gasy* and *betsabetsa*. Third, collection of data determining what educational knowledge the conservation organizations are attempting to teach to rural farmer and to what degree the farmers can identify these items to compare with their knowledge of *tavy*. In other words, the distribution of western conservation and agricultural knowledge must be identified and quantified. Finally, a consumer schema of rice is needed to complete the understanding of how rice is understood by the Malagasy people.

The main contribution of this research towards the development of a culturally appropriate agricultural development program is that the beliefs of the Malagasy are not identical, not even in a small area, such as Andasibe. Those farmers living in Andasibe know less ritual behaviors than those living in the more rural areas of Mahatsara and Ampangalatsary. This variation in beliefs suggests that one development program cannot

be made that would address the cultural variation in beliefs for an area as small as that of this research. The current danger of the conservation programs in Madagascar is that they will favor technological advancement at the cost of cultural preservation. For example, the merchants and farmers prefer red rice, yet organizations that are leading the change of agriculture in Madagascar are ignoring preferences for technology, which may lead toward project failure. However, with the addition of this research to their repertoire, one hopes that these organizations and others will acknowledge and take into consideration culture when attempting to change people's lives.

Appendices

Appendix 1

Farmer Survey Instrument (English)

This is completely anonymous. We will never tell anyone with whom we spoke.

I. Demographic

1) How old are you?
2) What is your ethnicity? (example answer *Betsimisaraka*, *Bezanozano*)
3) What is your religion?
4) How long have you lived here?
5) How long have you been a farmer?
6) What do you grow?
7) What else do you do besides farm?
8) Do you grow rice on irrigated fields?
9) Have you ever done *tavy*?
10) How long ago?

II. Cultural Model I

4. Completely agree
3. Somewhat agree
2. Somewhat disagree
1. Completely disagree

1) You should ask the *tangalamena* where to do *tavy*.

2) You should pray to the *zanahary* before preparing a place to do *tavy*.
3) You should offer paddy to the *zanahary* before preparing a place to do *tavy*.
4) You should offer rice to the *zanahary* before preparing a place to do *tavy*.
5) You should offer honey to the *zanahary* before preparing a place to do *tavy*.
6) You should offer rum to the *zanahary* before preparing a place to do *tavy*.
7) You should offer *betsabetsa* to the *zanahary* before preparing a place to do *tavy*.

8) You should pray to *andriamanitra* before burning.
9) You should offer paddy to *andriamanitra* before burning.
10) You should offer rice to *andriamanitra* before burning.
11) You should offer honey to *andriamanitra* before burning.
12) You should offer rum to *andriamanitra* before burning.
13) You should offer *betsabetsa* to *andriamanitra* before burning.

14) You should pray to the ancestors before planting.
15) You should offer paddy to the ancestors before planting.
16) You should offer rice to the ancestors before planting.
17) You should offer honey to the ancestors before planting.
18) You should offer rum to the ancestors before planting.

19) You should offer *betsabetsa* to the ancestors before planting.

20) You should pray to *andriamanitra* before planting.
21) You should offer paddy to *andriamanitra* before planting.
22) You should offer rice to *andriamanitra* before planting.
23) You should offer honey to *andriamanitra* before planting.
24) You should offer rum to *andriamanitra* before planting.
25) You should offer *betsabetsa* to *andriamanitra* before planting.

26) You should take six heads of rice to the *tangalamena* before harvesting.
27) You should pray with the *tangalamena* before harvesting.
28) You should take paddy to the *tangalamena* before harvesting.
29) You should take honey to the *tangalamena* before harvesting.
30) You should take *betsabetsa* to the *tangalamena* before harvesting.
31) You should take rum to the *tangalamena* before harvesting.

V. Last Questions

1) How can the agricultural problems in Madagascar be solved?
2) Do you do any rituals when you plant irrigated rice?
3) Would you feel any loss of identity as a farmer by not practicing *tavy*?
4) Is the current inflation affecting you?

Appendix 2

Farmer Survey Instrument (Malagasy)

Ity dia tsy zavatra mifamototra. Izahay dia milaza marina fa tsy misy ahina ny ataoeto tsy ivoaka aziza fa eto ihany.

1) Firy taona ianao?
2) Inona ny korazanao?
3) Inona ny finoanao?
4) Firy taona ianao no mipetraka teto?
5) Firy toana no mambolonao?
6) Ionona no karan-javatra hovolenao?
7) Ankoatra ny fambolena ataonao inona ny zavatra afa ataonao?
8) Moa mamboly vary amin'ny tanim-bary ve ianareo?
9) Efa nanao tavy ve ianao?
10) Oviana no nanaovanao tavy faramy?

    4 = Mifanaraka araky izany mihitsy.
    3 = Mifanaraka eo eo ihany.
    2 = Tsy mifanaraka eo eo ihany.
    1 = Tsy mifanaraka araky izany mihitsy.

1) Monontany an'ingahy tangalamena aho, taiza no nanaovanao tavy?

2) Misy fangatahana amin'ny zanahary atao rehefa anao tavy?
3) Misy vary fotsy apetraka ve rehefa hikarakara tavy?
4) Misy masom-boly apetraka ve rehefa hikarakara tavy?
5) Misy tantely apetraka ve rehefa hikarakara tavy?
6) Misy toaka-Gasy apetraka ve rehefa hikarakara tavy?
7) Misy betsabetsa apetraka ve rehefa hikarakara tavy?

8) Mikiaka zanahary ve rehefa andaro tavy?
9) Mametraka vary fotsy amin'ny zanahary ve rehefa andoro?
10) Mametraka masom-boly amin'ny zanahary ve rehefa andoro?
11) Mametraka tantely amin'ny zanahary ve rehefa andoro?
12) Mametraka toaka-Gasy amin'ny zanahary ve rehefa andoro?
13) Mametraka betsabetsa amin'ny zanahary ve rehefa andoro?

14) Mila mivavaka amin'ny razana ve rehefa amboly?
15) Mametraka vary fotsy amin'ny razana ve alohan'ny amboly?
16) Mametraka masom-boly amin'ny razana ve alohan'ny amboly?
17) Mametraka tantely amin'ny razana ve alohan'ny amboly?
18) Mametraka toaka-Gasy amin'ny razana ve alohan'ny amboly?
19) Mametraka betsabetsa amin'ny razana ve alohan'ny amboly?

20) Mivavaka amin'ny andriamanitra ve ianareo alohan'ny amboly?
21) Mametraka vary fotsy amin'ny andriamanitra ve ianareo alohan'ny amboly?
22) Mametraka masom-boly amin'ny andriamanitra ve ianareo alohan'ny amboly?
23) Mametraka tantely amin'ny andriamanitra ve ianareo alohan'ny amboly?
24) Mametraka toaka-Gasy amin'ny andriamanitra ve ianareo alohan'ny amboly?
25) Mametraka betsabetsa amin'ny andriamanitra ve ianareo alohan'ny amboly?

26) Mila afangaro amin'ny salohim-bary henina voalazan'ny tangalamena vao azo ato ny fambolem-bary?
27) Mila hitsitsian'ny tangalamena vao azo volena ny vary?
28) Mila mitondra masom-boly amin'ny tangalamena vao azo volena ny vary?
29) Mila mitondra tantely amin'ny tangalamena vao azo volena ny vary?
30) Mila mitondra betsabetsa amin'ny tangalamena vao azo volena ny vary?
31) Mila mitondra toaka-Gasy amin'ny tangalamena vao azo volena ny vary?

1) Mahafantatra ny olanan'ny famambolena eto Madagascar inona no entina hamahana io?
2) Misy fambofomba atao ve amin'ny tanim-bary alohon'ny hiady tatatra?
3) Raha ohotra mijanona ny tavy isika izao inoma ny zavatra hafa ataon'ny taranaka any aoriana?
4) Amin'ny izao fiakaran'ny solika izao dia inona ny zavatra tsapanareo amin'ny vidim-piainana?

Appendix 3

Farmer Sample

District/Community	Betsimisaraka		Bezanozano		Merina		Other[8]		Total		
Andasibe	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**T**
Ambody Voasary	3	2	-	-	-	-	-	-	3	2	5
Amparahevitra	3	2	-	-	-	1	1	-	4	3	7
Amparihy Malama	2	3	-	1	1	-	-	-	3	4	7
Ampitanin'ny Tanim-Bary	1	4	-	-	-	-	-	-	1	4	5
Antanampisaka	3	2	-	1	-	1	1	1	4	5	9
Lagare	3	2	1	-	1	1	-	-	5	3	8
Mangarivotra	4	1	1	-	1	-	-	-	6	1	7
Perinet II	2	3	-	-	1	-	-	-	3	3	6
Tanambaovao	-	5	2	-	-	-	-	-	2	5	7
Tanambe I	2	3	-	-	-	-	-	-	2	3	5
Total	23	27	4	2	4	3	2	1	33	33	66

District/Community	Betsimisaraka		Bezanozano		Merina		Other		Total		
Mantadia	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**T**
Mahatsara	18	31	2	5	-	-	-	3	20	39	59
Total	18	31	2	5	0	0	0	3	20	39	59

District/Community	Betsimisaraka		Bezanozano		Merina		Other		Total		
Ampangalatsary	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**T**
Amparihibe	3	2	-	-	-	-	-	-	3	2	5
Analamazaotra	1	4	1	-	1	-	1	1	4	5	9
Anevoka	4	1	-	-	-	-	-	-	4	1	5
Bazar-Zoma	2	3	-	2	-	-	-	-	2	5	7
Manambanana	3	2	-	-	-	-	-	1	3	3	6
Mangarivotra	2	3	-	-	-	-	-	-	2	3	5
Morafeno	3	2	1	-	-	-	-	-	4	2	6
Moramesa	4	1	-	-	-	1	-	-	4	2	6
Sahamamy I	3	2	-	-	-	-	-	-	3	2	5
Sahamamy II	2	3	-	-	1	-	-	-	3	3	6
Total	27	23	2	2	2	1	1	2	32	28	60

District/Community	Betsimisaraka		Bezanozano		Merina		Other		Total		
	M	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**T**
Grand Total	68	81	8	9	6	4	3	6	86	100	185

[8] Betsileo, Tesaka, Sakalava, Sihanaka, Tandroy, Tsimihety and Vezo.

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