

Swidden Agriculture and Conservation in Eastern Madagascar: Stakeholder Perspectives and Cultural Belief Systems

Douglas William Hume

Abstract: *This paper describes and discusses several stakeholders' perspectives of agricultural change in eastern Madagascar. The historic and current government-sponsored attempts to facilitate the end of swidden agriculture in eastern Madagascar have largely failed due to particular cultural beliefs held by the rural farmers. 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. One key aspect of planned agricultural change ignored by the Malagasy government is the impact this change will have on the rural farmers' belief system connected with their traditional agriculture, tavy (swidden agriculture as termed and practised by the Malagasy). As the current plan of the Malagasy government stands, only the political, agricultural, ecological, and economic problems of the agricultural change are part of policymaking. In addition to perspectives from government-sponsored programmes, economic and cultural viewpoints from local rice sellers and rural farmers are presented.*

Keywords: Madagascar, tavy, agriculture, culture, policy, farmers, rice, swidden agriculture

INTRODUCTION

THE HISTORIC AND CURRENT GOVERNMENT-SPONSORED attempts to facilitate the end of swidden agriculture in eastern Madagascar have largely failed due to particular cultural beliefs held by rural farmers. In many parts of eastern

Douglas William Hume, Department of Anthropology, Beach Hall, U-2176, 354 Fairfield Road, University of Connecticut, Storrs, Connecticut 06269-2176, USA.

Address for Correspondence

Douglas William Hume, Department of Anthropology, Beach Hall, U-2176, 354 Fairfield Road, University of Connecticut, Storrs, Connecticut 06269-2176, USA.

E-mail: dwhume@gmail.com

Conservation and Society, Pages 287–303

Volume 4, No. 2, June 2006

Copyright: © Douglas William Hume 2006. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use and distribution of the article, provided the original work is cited.

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, conservation organisations, and developmental agencies are seeking to implement several agricultural and social policies designed to promote biodiversity conservation and increase crop yields to meet the increased needs of the rising human population. Since rice is the staple of the Malagasy diet, consumed in greater quantities per capita than any other nation [yet has been in decrease from 150 kg/year in 1977 to 118 kg/year in 1995 (IRRI 2004)], increasing crop yields is an important development goal for the country as a whole. One key aspect of planned agricultural change ignored by the Malagasy government is the impact this change will have on the rural farmers' belief system connected with their traditional agriculture, *tavy* (swidden agriculture as termed and practised by the Malagasy). *Tavy* involves several rituals that appease gods, ancestors and spirits that inhabit the land. Without participating in these rituals, many farmers in eastern Madagascar believe that their sense of identity as farmers will be lost (see also a similar discussion in 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 also take into account the political, agricultural, ecological, economic 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 part of policymaking.

Humans and Conservation in Madagascar

Due to Madagascar's history, large size and isolation from the African continent, remnant floral and faunal populations have survived where they have not elsewhere. In terms of the number of endemic flora and fauna found per 100 square kilometres (Myers et al. 2000), Madagascar has recently been cited as being one of the topmost biodiversity conservation concerns. An additional concern to conservation groups is that less than 10 per cent of primary growth vegetation remains in Madagascar (Nelson and Horning 1993; Du Puy and Moat 1996; Myers et al. 2000). The remnant forest in eastern Madagascar is undergoing deforestation by estimated rates of 1.6 to 9.5 per cent a year (Dufiles 2003). Since Madagascar contains approximately 3.2 per cent of the global plant species and 2.8 per cent of the global vertebrate species, this continued drastic loss of habitat jeopardises the survival of a significant portion of global biodiversity (Myers et al. 2000). The importance of conserving biodiversity in Madagascar is further illustrated in that 75 to 85 per cent of the species in Madagascar are endemic (Glaw and Vences 1994; Mittermeier et al. 1994; Dransfield and Beentje 1995). The extinctions that occur in Mada-

gascon influence not only the local biodiversity, but have global ramifications as well.

Anthropogenic degradation and fragmentation of Madagascar's forests have been interpreted as a principal cause of the decline of many endemic species of flora and fauna, 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). Because human populations were low when the catastrophic extinctions occurred in Madagascar (ca. 2000 to 1500 years ago), the extinction of species due to forest loss is only a recent phenomenon (Dewar 1997). Human exploitation of Madagascar's natural resources is occurring at an increasing rate from both local population pressure and international mining interests (Jarosz 1993).

Tavy is of particular interest both locally and internationally to scientists and conservation groups in Madagascar not only because of its ascribed adverse effects on the endemic flora and fauna, but also because, as practised with current human population densities in many parts of eastern Madagascar, it is both ecologically and economically unsustainable. Several institutions and agencies, such as *Système de Riziculture Intensif* (Moser and Barrett 2005), 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 agencies and institutions also seek to protect the remnants of rainforest that remain and hope to restore the degraded areas that surround protected areas. The practice of *tavy* at present levels prevents this restoration due to short fallow periods and lack of productive land. The agencies and institutions' goal, then, is to end the practice of *tavy* by providing alternative means of agricultural production that is ecologically and economically viable for the area. 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.

Culture and Conservation

In environmental degradation problems such as those faced by Madagascar, a top-down approach in implementing a conservation programme is not feasible since governmental infrastructure needed for such a task is not available. In other words, many developing countries, including Madagascar, cannot afford to fund the maintenance of conservation efforts. The economic resources that are needed to design, pass into law and finally enforce legislation are absent. Since the actors are rural farmers, benefits from fining subsistence level individuals cannot substantially offset the costs of enforcement. In place of an institutional approach, there is a growing trend towards community-based conservation, 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; Rabetaliana and Schachenmann 1999).

Conservation projects have attempted to increase awareness among local populations through reviving ancestral technologies (e.g., Cornista and Escueta 1990), calling on a traditional conservation ethic (e.g., LaDuke 1992), or education of contemporary conservation methods (e.g., Palmer et al. 1991). It is clear that the belief systems of a community involved in a conservation project must be understood before any project can begin, but in practice, it is rarely achieved. Instead, ecologists, economists and other policymakers design the conservation project without understanding or incorporating the belief systems of the communities involved. In most cases, a cursory examination of knowledge is completed to develop education programmes that instruct the communities in new technology or methods of resource use. A thorough examination would be required to allow cultural beliefs to be integrated within the whole of the project.

Not only must local populations have knowledge of conservation, but they must have land-tenure and economic rights, responsibilities and capabilities to be able to succeed in conservation efforts (Western and Wright 1994). Land-tenure rights are 'an essential element of any community-based conservation [CBC] initiative' (Lynch and Alcorn 1994: 390). The communities must have control over the location where the resource is located to restrict use of the resource (Lynch and Alcorn 1994). This control may either take the form of private land ownership or common property. 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 is in effect, no level of enforcement is able to curb resource degradation. Therefore, for conservation efforts to succeed, any CBC programme must include economic benefits and resources for the participating local community.

METHODS

Interviews of Malagasy governmental and non-governmental agencies were carried out during fieldwork in 2003 (January through July). The directors and the available technical personnel of the following institutions and agencies were interviewed: *Ministre de la Recherche Scientifique*, *Direction Inter Regionale Centre*, *Regional de Recherche Est (FOFIFA)*, *Toamasina*; *Ministre des Eaux et Forêts (MEF)*, *Toamasina*; *Ecole d'Application des Sciences et*

Techniques Agricole (EASTA), Analamalotra, Toamasina; Ministre de l'Agriculture et de l'Elevage (MAE), Direction Inter Regionale du Developpement Rural Toamasina; and L'Association Nationale pour la Gestion des Aires Protégées (ANGAP), Toamasina and Parc National D'Andasibe. All interviews took place with one or two Malagasy interpreters. The topical focus of interviews was the role that a particular agency had in the development or conservation of eastern Madagascar's environmental resources as well as what, if any, solutions to the current agricultural problems were being implemented.

Farmers and merchants were interviewed intermittently during this same period as well as during a fieldwork in 2004 (May through July). 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 the types of rice customers prefer. Each rice merchant in *Bazary Kely* had an opportunity to take part in the interview. Of the fifty-two people who were interviewed, and only five declined. 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. In both 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. In Andasibe, 187 farmers who were part of a project to understand the cultural model of *tavy* (Hume 2005), were asked open-ended questions about their role in the development of agriculture and their opinions on what solutions were feasible. While the focus of the research was on the Besimisaraka ethnicity, all ethnicities were included in the sample as long as they were permanent residents of the area.

RESULTS

Although there are excellent reviews on the relationship of conservation and cultural practices among the Malagasy (e.g., Dolch 2003), the authors largely ignore the ritual and cultural impacts that agricultural change would invoke, while citing lack of knowledge, property rights or environmental constraints as the hindrances responsible for the failure to switch from *tavy* to *tanimbary* (irrigated agriculture) (e.g., Oxby 1985; Ford 1996; Kistler and Spack 2003). Still others note that there are cultural beliefs that prevent agricultural change, but do not offer a solution to the development dilemma of agriculture in eastern Madagascar (e.g., Erdmann 2003). Exceptions include discussions about the ritual and spiritual aspects of *tavy*, but do not link these with government assertions of farmer practices and therefore do not complete the linkage of policy and belief systems (e.g., Moor and Barck 1997). The interviews considered here are focused upon how the move towards *tanimbary* rice influences cultural beliefs, which is a novel approach not apparent in the current

literature. 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 such change would bring about in the cultural beliefs of 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 stakeholder:

- MAE – Provide techniques to increase agricultural yield.
- FOFIFA – Provide crop seeds that improve 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 a living from 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. Analysis of each organisation's views is reserved for discussion after all views have been presented.

Ministre de l'Agriculture et de l'Elevage , Direction Inter Regionale du Developpement Rural Toamasina

In addition to its other duties, the MAE in Toamasina instructs rural farmers on innovative farming techniques to increase their crop yields (e.g., rice, corn, cassava, etc.). To aid farmers, there are only two agricultural technicians for the entire Toamasina Province, which comprises approximately 71,911 square kilometres (INS 2004). One is based in the city of Maroantsetra and the other in Toamasina. The technician based in Toamasina stated that there is no solution to the current agricultural problems in Madagascar because the rural farmers were following their customs and they would not change their ways to accommodate new agricultural methods (Ministre de l'Agriculture 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 from using a swidden farming method, (4) human population increase, and (5) the extended period that the environment takes (approximately fifty-years) to become sec-

ondary forests after being cleared and burned (Ministre de l'Agriculture Director, personal communication, May 5, 2003). His solution was to use a terraced *tanimbary* system, but he knew that this was an improbable solution due to the economic constraints of the ministry. He remains optimistic that an international non-governmental organisation will provide the funds to develop agriculture in Madagascar.

Ministre de la Recherche Scientifique, Direction Inter Regionale Centre, Regionale de Recherche Est, Toamasina

One of the branches of the Ministre de la Recherche Scientifique (FOFIFA) has the goal of providing hybrid and genetically engineered seeds 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 the 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 it rice, vanilla or other crops. Finally, the funding of such programmes 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 seeds). 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 labour, water, and chemical fertilisers, while preserving natural resources and protecting the environment' (IRRI 2004: 1–2). In spite of how conservation friendly their stated goals are, the IRRI is primarily concerned with providing genetically engineered seeds to increase rice yield. For example, FOFIFA, with the assistance of the IRRI in 1983, introduced a new variety of *tanimbary* rice, designated R8, which eventually failed because 45 per cent of the rice kernels were broken when processed, which is unacceptable to consumers. Yet, the reported results of crop yields of 6 to 10 tons per hectare in experimental *tanimbary* by the IRRI in the mid-1980s continue to provide the impetus for continued experimentation with high yield seed varieties (Vallois 1996). Currently FOFIFA is attempting to produce enough of another variety, designated B22, for use with *tavy*. They claim that this white rice can yield 3000 kg per hectare as compared to current varieties, which only yield about 1,000 kg per hectare. It has been unsuccessful with the B22 variety because the farmers

who grow the rice for seed consume the rice instead of selling the seed to FOFIFA for redistribution. FOFIFA claims that the farmers will use this new white rice variety even though there is a strong preference for red rice simply because 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 fertilisers or herbicides (FOFIFA Director, personal communication, June 4, 2003). In addition, other agricultural methods require more labour than *tavy*. He suggested that farmers should organise themselves into cooperatives so that the various departments and ministries can work with them at the group level to find solutions and perhaps eventually mechanise Malagasy agriculture (FOFIFA Director, personal communication, June 4, 2003). However, a barrier to this process is that the farmers do not own the land that they use for agriculture and there are no incentive funds for individual farmers to begin such a process alone (FOFIFA Director, personal communication, June 4, 2003).

Ecole d'Application des Sciences et Techniques Agricole, Analamalotra, Toamasina

Eight kilometres north of the city of Toamasina lies 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 *tanimbary* is grown with the assistance of fertilisers and herbicides. The price to fertilise a one-hectare field costs about 2,000,000 Malagasy Ariary (MGA; 1600 USD¹) and yield using this system is 3500 kg per hectare (EASTA student, personal communication, May 8, 2004). At average retail prices of 500 MGA (0.40 USD) per kilo for local rice, the rice for one hectare would be 1,750,000 MGA (1400 USD). Using this system, there is a deficit of 250,000 MGA (200 USD) per crop. The system of agriculture that is taught to the students at this school is not currently economically feasible unless the government subsidises the farmers, which with the current economic state of Madagascar, is highly unlikely.

Ministre des Eaux et Forêts, Toamasina

The Ministre 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 processes farmers' requests to practise *tavy* in these areas and provides 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 the responsible farmer cannot be identified, the village is fined 340,000 MGA (300 USD). Difficulty lies with the fact that the ministry is under-staffed and under-funded, so the areas that are not easily accessible due to the lack of good roads are not regularly monitored.

The Director of the MEF stated that the practice of *tavy* must end (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 *tanimbary* that will eventually result in the end of *tavy*. 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.

L'Association Nationale pour la Gestion des Aires Protégées, Toamasina

The agricultural practices of the communities located in protected areas are monitored by L'Association Nationale pour la Gestion des Aires Protégées (ANGAP). The ANGAP serves as a semi-autonomous Malagasy non-governmental organisation that manages protected areas. Both of ANGAP's offices, in Toamasina and Andasibe, affirm that the practice of *tavy* must end in order to protect the natural resources of Madagascar. To this end, they are beginning projects 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 (Toamasina Branch Director, personal communication, May 23, 2003).

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

Market Rice Sellers

Sixty-seven rice sellers who were interviewed in markets within the city of Toamasina, many of whom were or currently are rice farmers, told a slightly

different story than that of the governmental offices. 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 where the rice is grown, (2) method used to grow the rice, (3) approximate age of the rice, (4) smell, (5) colour, (6) amount broken, and (7) shape and size of kernels. The first categorisation of rice types made by rice seller is between *vary stok* (old rice) and *vary gasy* (fresh local rice). *Vary stok* is the least expensive and includes both *stok importe* (imported rice) and *vary kitra* (old local rice). Since *vary stok* is dehydrated, after it is cooked it will provide more bulk than freshly grown rice. *Vary stok* is usually only bought by poorer customers because it is both cheaper and yields more food per dry measure.

Regardless of price, the rice sellers report that there is a strong preference for locally grown rice. The most common reasons given for this preference are: (1) it tastes better, (2) it is better for digestion (healthier), (3) it has more vitamins, and (4) it has no chemicals. Customers also prefer red rice over white rice as it is believed to have more vitamins. *Vary gasy* are first delineated by their colour, *vary fotsy* (white rice) and *vary mena* (red rice). Each of these coloured varieties are then delineated by the location that they were grown (e.g., *makalioka fotsy* - white rice grown primarily in Ambatondrazaka and *tsipala* - white rice grown primarily in Antananarivo). The importance of location is based upon how the rice is processed. For example, *tsipala* processed in the Antananarivo region contains small rocks from ground thrashing. Machine-processed rice yields a greater quantity of broken kernels. Customers in Toamasina prefer rice processed by thrashing in 50-kg rice sacks than the machine processed rice. Among the local varieties, both grown on *tanimbary* and *tavy*, both white and red – the red rice grown by *tavy* is preferred by the majority of the customers. It is believed that red *tavy* rice is the most nutritious and healthy of all varieties of rice.

Rural Farmers

All the farmers interviewed in Toamasina, Brickaville and Andasibe were aware that *tavy* destroys the environment, meaning the naturally growing forests. Though there were different reasons 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 practise *tavy*. They must feed their families and no one, neither the government as a whole nor any of the organisations listed above, is giving them any assistance. They are aware of organisations 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 are aware of a government program to help them transition to *tanimbary* and that offers the ownership of land, but they that the land is not fit for farming.

All the farmers interviewed pursue both *tavy* and *tanimbary*. They do *tavy* on the sides or tops of hills and maintain *tanimbary* fields in the valleys and by rivers. On their *tavy* fields, the farmers produce two years of rice and subsequently three of cassava. They do not have enough land to let the land fallow for more than three years before returning to plant again. They agree that the rice yields have been diminishing over the years and buy imported rice in addition to the rice that they grow. The farmers harvest about 1500 to 3000 kg of rice per hectare. There is not enough good land for farming remaining on the east coast of Madagascar.

The farmers concur with the market rice sellers that red rice tastes better and it has more vitamins than white rice. They also state that the white rice grown by *tanimbary* in Madagascar has the same taste as imported rice. They 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 the 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 *tanimbary*. They think that this form of agriculture is laborious, but if they could grow more rice and become self sufficient, they would do it. They 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, the farmers believe that since they would have land to grow their food, the rest of the landscape should be allowed to regrow into forest or be replanted because degradation of forests has impacted the environment in general. Farmers recognise that one of the effects of deforestation is that the climate is drier and there is now less rain.

During a 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 who will teach them a better method of 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 used to make the soil 'hot' are burning and fertiliser. Since the farmers cannot afford fertiliser, their only option is to burn so that their crops will grow.

In addition to their difficulty with earning money and trying to learn new methods of agriculture, the current inflation in Madagascar is affecting their ability to continue living in their current way. The price of rice rose from 450 MGA to more than 700 MGA in a matter of months. The price to take a *taxi-brousse* (local bus) to Moromanga has risen from 1000 MGA to 1400 MGA. Moromanga is the nearest location from Andasibe to buy medications and for

children to complete exams to continue their education in the public school system. In addition, the price of petrol has risen from 4500 to 8500 FMg per litre. Petrol is used on a limited basis for cooking, but also as a form of cheap light in houses that do not have 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 alright 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 not alright to go hungry. I fear that the poor will revolt against the rich because they are hungry.'

DISCUSSION

As presented above, the stakeholders in the development of agriculture have different, but complementary views of potential solutions. The MAE suggests that the best solution to the current agriculture problems in eastern Madagascar is to find international funding and teach farmers how to do terraced *tanimbary*. FOFIFA has developed several varieties of rice for the conditions in eastern Madagascar that result in increased crop yields. In FOFIFA's view, farming cooperatives and land tenure will help ensure agricultural development. EASTA has developed high yield crops and trained technicians in high yield methods, while not economically viable at this time, may lead to other methods that also have high crop yields. MEF suggests that by building dams, *tanimbary* fields may be irrigated. The market rice sellers believe that by developing *vary mena*, customers will accept the new variety as healthy. Finally, the rural farmers suggest that dams should be built and forests replanted. The farmers appear willing to accept change as long as they benefit.

The culture of *tavy* and its relationship to behaviour are largely ignored by some stakeholders. Only one of the governmental organisations (ANGAP) recognised that *tavy* was more than an agricultural method and that it should be understood before any agricultural change is planned. *Tavy* is not only a method for growing rice, but is ritualised and contains meanings that relate to god, ancestors and other spirits that inhabit the landscape. 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 god is made, something that is not done when doing *tanimbary*. 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. The rice is dried over a fire, which is in an iron box sunk into the ground.
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* (fermented sugar cane juice) and rum.
5. The farmer then pray over the rice, led by the *tangalamena* (holder of the customs), to remove the *tsiny* (malicious spiritual powers) so that the farmer may harvest the rice and bring it to their home, thereby bringing the health of the field into their home.
6. The farmer and *tangalamena* may eat fish with the rice during this rite, but no other meat.

When asked, the farmers stated that a part of them would be lost—their identity—if they no longer practised *tavy* and its associated rituals. The transition from *tavy* to *tanimbary* will result in the loss of meanings ascribed to farming. All the farmers who were interviewed practised both *tavy* and *tanimbary*. None practised the rituals associated with *tavy* when doing *tanimbary*. 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.

None of the farmers could explain what they would do if they were forced to halt *tavy*. Without a viable alternative, rural farmers will have no choice but to continue practising *tavy* and continue the degradation of Madagascar's natural resources. The farmers admit 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 the rice they grow with purchased imported rice, as the fields no longer produce enough rice to support the farmers. They 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 have neither the resources nor the faith in the new systems of agriculture to change. They 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.

Along with the loss of cultural rituals and a sense of identity, preferences for specific types of rice will be problematic for farmers, rice sellers and consumers causing economic stress on an already stressed economy. FOFIFA assumes that the farmers will welcome agricultural techniques that increased crop yields, regardless of how these new techniques effect the farmer's beliefs. In addition, FOFIFA assumes that price and availability are the most important factors when purchasing rice, ignoring the strong preference for red rice as stated by the rice merchants. 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 are unwilling to consume it when there are other alternatives. One cannot simply replace a ritual 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 *tavy* and conservation will enhance the probability of the success of the planned change.

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 received 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 to him. He was asked if he would be willing to teach others, the farmer 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 farmers, 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 among themselves. There is a lack of communication among 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 among farmers or from another organisation (governmental or non-governmental), farmers will not be able to shift from *tavy* to *tanimbary* on their own.

CONCLUSION

There are three lessons to be learned from the current agricultural crisis in Madagascar. First, resistance to cultural change may occur if the non-indigenous knowledge introduced does not mitigate the loss of meanings ascribed to *tavy* by the local population. *Tavy* is prohibited in certain areas; however, it continues with little abatement with the current regulation. To avoid paying fines, farmers simply attribute the burns to other phenomena or nothing at all, without acknowledging ownership. Second, in addition to outright resistance, 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 practising *tavy* and continue the degradation of Madagascar's natural resources. The farmers have expressed that they are cognisant 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. They feel a loss of identity as a farmer with the loss of *tavy*. 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. This is a classic example of a development project that ignores culture and attempts to fix a problem with money and through technology. 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 *tavy* and conservation will enhance the probability of the success of the planned change.

Acknowledgements

This research was partially funded by a Doctoral Dissertation Research Improvement Grant, National Science Foundation (BCS-0349981, James Boster PI). The author wishes to acknowledge Jeffrey Kaufmann, Richard Sosis, Samuel Martinez, and Sarah Hume, all of whom offered editorial and content comments on earlier drafts of this paper. Two anonymous reviewers for this journal provided useful critiques and insights, for which they are appreciated. Any errors remain the author's responsibility.

Notes

1. The conversions from Malagasy Francs to United States Dollars is based on the average currency conversion rates for May 2003 (1250 MGA to 1 USD), which was the period when interviews at EASTA took place and average retail prices for local varieties of rice were collected in Toamasina markets.

REFERENCES

- Cornista, L.B. and E.F. Escueta. 1990. Communal Forest Leases as a Tenurial Option in the Philippine Uplands. In: *Keepers of the Forest: Land Management Alternative in Southeast Asia* (ed. M. Poffenberger), pp. 134–144. Kumarian Press, West Hartford, Connecticut.
- Dewar, R.E. 1997. Were People Responsible for the Extinction of Madagascar's Subfossils, and How Will We Ever Know? In: *Natural Change and Human Impact in Madagascar* (eds. S.M. Goodman and B.D. Patterson), pp. 364–377. Smithsonian Institution, Washington D.C.
- Dolch, R. 2003. Andasibe (Périnet): Are Current Efforts Sufficient to Protect Madagascar's Biodiversity Hot Spot? In: *The Natural History of Madagascar* (eds. S.M. Goodman and J.P. Benstead), pp. 1480–1485. University of Chicago Press, Chicago.
- Dransfield, J. and H. Beentje. 1995. *The Palms of Madagascar*. Royal Botanic Gardens, London.
- Du Puy, D.J. and J. Moat. 1996. A Refined Classification of the Primary Vegetation of Madagascar Based on the Underlying Geology, Using GIS to Map its Distribution and to Assess its Conservation Status. In: *Biogéographie de Madagascar* (ed. W.R. Lourenco), pp. 205–218. ORSTOM, Paris.

- Dufiles, J.M. 2003. Remaining Forest Cover. In: *The Natural History of Madagascar* (eds. S.M. Goodman and J.P. Benstead), pp. 88–96. University of Chicago Press, Chicago.
- Erdmann, T.K. 2003. The Dilemma of Reducing Shifting Cultivation. In: *The Natural History of Madagascar* (eds. S.M. Goodman and J.P. Benstead), pp. 134–139. University of Chicago Press, Chicago.
- Ford, R. 1996. *Negotiating Conservation: Reflections on Linking Conservation and Development in Madagascar*. Clark University, Worcester, Massachusetts.
- Glaw, F. and M. Vences. 1994. *A Fieldguide to the Amphibians and Reptiles of Madagascar, Second Edition*. Privately Published, Koln, Germany.
- Godfrey, L.R., W.L. Jungers, K.E. Reed, E.L. Simons and P.S. Chatrath. 1997. Subfossil Lemurs: Inferences about Past and Present Primate Communities in Madagascar. In: *Natural Change and Human Impact in Madagascar* (eds. S.M. Goodman and B.D. Patterson), pp. 218–256. Smithsonian Institution, Washington D. C.
- Harper, J. 2002. *Endangered Species: Health, Illness and Death Among Madagascar's People of the Rainforest*. Carolina Academic Press Ethnographic Studies in Medical Anthropology. Carolina Academic Press, Durham.
- Hume, D.W. 2005. Agriculture in Madagascar: Conservation and Cultural Meanings of Rice. Ph.D Dissertation. University of Connecticut.
- INS. 2004. Madagascar en Chiffres. <http://www.geohive.com/cd/link.php?exl=mg&exl=xs4>, accessed May 14, 2004, Institut National de la Statistique.
- IRRI. 2004. Facts About Cooperation: Madagascar and the IRRI. <http://www.irri.org/media/facts/pdfs/madagascar.pdf>, accessed May 14, 2004, International Rice Research Institute.
- Jarosz, L. 1993. Defining and explaining tropical deforestation: shifting cultivation and population growth in colonial Madagascar (1896–1940). *Economic Geography* 69(4):366–379.
- Kistler, P. and S. Spack. 2003. Comparing Agricultural Systems in Two Areas of Madagascar. In: *The Natural History of Madagascar* (eds. S.M. Goodman and J.P. Benstead), pp. 123–134. University of Chicago Press, Chicago.
- Klerymeyer, C.D. 1994. Cultural Traditions and Community-Based Conservation. In: *Natural Connections: Perspectives in Community-based Conservation* (eds. D. Wester and R.M. Wright), pp. 323–346. Island Press, Washington D.C.
- LaDuke, W. 1992. Indigenous environmental perspectives: a North American primer. *Akwe:kön Journal* 9(2):52–71.
- Langrand, O. and L. Wilmé. 1997. Effects of Forest Fragmentation on Extinction Patterns of the Endemic Avifauna on the Central High Plateau of Madagascar. In: *Natural Change and Human Impact in Madagascar* (eds. S.M. Goodman and B.D. Patterson), pp. 280–305. Smithsonian Institution, Washington D. C.
- Little, P.D. 1994. The Link Between Local Participation and Improved Conservation: A Review of Issues and Experiences. In: *Natural Connections: Perspectives in Community-based Conservation* (eds. D. Western and R.M. Wright), pp. 347–372. Island Press, Washington D.C.
- Lynch, O.J. and J.B. Alcorn. 1994. Tenurial Rights and Community-Based Conservation. In: *Natural Connections: Perspectives in Community-based Conservation* (eds. D. Western and R.M. Wright), pp. 373–392. Island Press, Washington D.C.
- Mittermeier, R.A., I. Tattersall, W.R. Konstant, D.M. Meyers, and R.B. Mast. 1994. *Lemurs of Madagascar*. Conservation International, Washington D.C.
- Moor, P. and S. Barck. 1997. Les Facteurs Socio-Culturels et Leurs Impacts sur le Développement Rural. In: *Us Système Agroécologique Dominé par le Tavy: La Région de Beforona, Falaise est de Madagascar*, pp. 139–53. Projet Terre-Tany/BEMA, Antananarivo.
- Moser, C.M. and C.B. Barrett. 2005. The Complex Dynamics of Smallholder Technology Adoption: The Case of SRI in Madagascar. In: *Ilo Working Paper*: <http://www.ilo.cornell.edu/>.
- Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. Da Fonseca and J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403:853–858.

- Nelson, R. and N. Horning. 1993. AVHRR-LAC estimates of forest area in Madagascar, 1990. *International Journal of Remote Sensing* 14:1463–1475.
- Oxby, C. 1985. Forest farmers: the transformation of land use and society in eastern Madagascar. *Unasylva* 37:42–51.
- Palmer, P., J. Sanchez and G. Mayorga. 1991. *Taking Care of Sibö's Gifts: An Environmental Treatise from Costa Rica's Kékölki Indigenous Reserve*. Asociación de Desarrollo Integral de la Reserva Indígena Cocles/Kékölki, San José, Costa Rica.
- Rabetaliana, H. and P. Schachenmann. 1999. Coordinating traditional values, scientific research and practical management to enhance conservation and development objectives in the Andringitra Mountains, Madagascar; lessons learned. *African Studies Quarterly* 3(2).
- Sorg, J.-P., H. Hurni, R. Schlaepfer, J.-L. Pfund, P. Messerli, S. Michel, P. Kistler, and L.R. Fara. 2000. Ecological Evaluation and Sustainable Management of Natural Resources in the Zones of Shifting Cultivation in Madagascar. Recherche subventionnée par le FN; Thèse. Electronic Document, http://www.sidos.ch/fw_query/siweb2.fwx?htm.sel0=6644, accessed January 30, 2005.
- Vallois, P. 1996. Discours de la Methode du Riz: Rapport sur la Nouvelle Riziculture Malagache, Considérée Sous ses Aspects Techniques, Théoriques, Économiques, Sociologiques et Culturels. Institut de Promotion de la Nouvelle Riziculture, Antananarivo, Madagascar.
- Western, D. and R.M. Wright. 1994. The Background to Community-based Conservation. In: *Natural Connections: Perspectives in Community-based Conservation* (eds. D. Western and R.M. Wright), pp. 1–12. Island Press, Washington D.C.