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Madagascar Environmental Threats and Opportunities Assessment 2008 Update

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EPIQ IQC Contract No. EPP-I-00-03-00014-00, Task Order 02

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One of the characteristics of doing an assessment such as this one is that the field work is completed within a short time. This means that the logistics of moving team members around on the ground has to be carefully prepared and there is usually not much “wiggle room” for unexpected contingencies. This also means that the assessment team must rely heavily on the cooperation and goodwill of others, and this ETOA update was no exception. The entire team is very appreciative of the time given generously by individuals and institutions in our effort to understand the current situation of tropical forests and biodiversity conservation in Madagascar. In Annex E we list the names of those to whom we owe our deepest appreciation for the time they spent with us. There are also several individuals who contributed an extraordinary amount of their time, particularly outside of the normal workday, to help the assessment team with logistics, arranging meetings and interviews, editing and comments of draft text and general support. These include the administrative staff of the BAMEX project office, and in particular, Joel Andriamahenina. Josoa Razafindretsa, Tiana Razafimahatratra and Lisa Gaylord of USAID/Madagascar who were all tireless in assisting us with contacts, providing an historical background and documents, and reviewing drafts of text. Jennifer Talbot of the Jariala project in Taolagnaro, Mark Freudenberger of the ERI project in Fianarantsoa, and Martin Nicoll of WWF in Antananarivo and Toliara were particularly helpful in explaining details about specific conservation and protection activities and helping us arrange field site visits and interviews outside of the capital. We are most indebted to all of these people and we sincerely hope that this assessment may also be of value to them and their organizations.

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ACRONYMS

ADRA	Adventist Development and Relief Agency
AGERAS	Appui à la Gestion Régionalisée et à l'Approche Spatiale
AGEX	Agence d'Execution
ANAE	Natinal Association for Environmental Action
ANGAP	Association Nationale pour la Gestion des Aires Protégées
BAMEX	Business and Market Expansion Project
CI	Conservation International
CIME	Interministerial Committee on the Environment
CIRAD	French Agricultural Research Centre for International Development
CITES	Convention on the International Trade of Endangered Species
CNE	National Committee on the Environment
COAP	Code de gestion des Aires Protégés
DSRP	Poverty Reduction Strategy Document
EEZ	Exclusive Economic Zone
EFSUM	Rational Forestry Management
EIA	Environmental Impact Assessments
EMC	Integrated Coastal Management
ERI	Eco-Regional Initiatives Program
EP	Environment Program (as in EP1, EP2, EP3)
ETOA	Environmental Threats and Opportunities Assessment
FAA	Foreign Assistance Act (of the U.S. Government)
FOFIFA	Natinoal Agriculture and Plant Breeding Institute
GAPCM	Association of Shrimp Fishermen and Aquaculture Operators
GCF	Forest Management Contracts
GELOSE	Gestion Locale Sécurisée, Secured Local Management of Natural Resources
GOM	Government of Madagascar
GRAP	Management of the Protected Areas
ICAM	Integrated Coastal Area Management
ICDP	Integrated Conservation and Development Projects
IFAD	International Fund for Agricultural Development
IHSM	Institut Halieutique et des Sciences Marines
IMF	International Monetary Fund
IRG	International Resources Group
IUCN	The World Conservation Union
KEPEM	Knowledge of Effective Policy in Environmental Management
LDI	Landscape Development Interventions
MAP	Madagascar Action Plan

MBG	Missouri Botanical Garden
MCA	Millennium Challenge Account
MCC	Millennium Challenge Corporation
MECIE	Mise en Compatibilité des Investissements avec l'Environnement
MEEFT	Ministry of Environment, Waters and Forests, and Tourism
MIRAY	Support to Protected Areas Plan
MRPH	Minstry for Fisheries and Marine Resources
NEAP	National Environmental Action Plan
NSSMB	National Strategy for the Sustainable Management of the Biodiversity
ONE	Office National pour l'Environnement
PA	Protected Area
PADR	Plan d'Action pour le Développement Rural, Rural Development Plan
PAGE	Support to Environmental Policy
PDFN	National Forestry Plan
PDRR	Plans de Développement Rural Régional
PIC	Integrated Poles of Growth
PNDR	Programme National de Développement Rural
QMM	Qit Minerals Madagascar
REDD	Reducing Emissions for Deforestation and Degradation
SAGE	Service d'Appui à la Gestion de l'Environnement
SAPM	Système d'Aires Protégées de Madagascar
SAVEM	Sustainable Approaches to Viable Environmental Management
SNGF	Silo Nationale des Graines Forestières
SOW	Scope of Work
USAID	United States Agency for International Development
WCS	Wildlife Conservation Society
WRI	World Resources Institute
WWF	World Wildlife Fund
ZPI	Priority Intervention Zone

1.0 INTRODUCTION

1.1 Purpose and Background of this Assessment

The Environmental Threats and Opportunities Assessment (ETOA) is the principal task addressed in this update, which was first conducted in February and March 2002. The ETOA described the actions to conserve biodiversity and tropical forests in Madagascar. Specific tasks for this assignment can be viewed in the Scope of Work (SOW) found in Annex A.

Excerpts of the 2002 ETOA are included in this document in sections 2.1, 3.1, and 4.1 as background to the 2008 analysis, which focuses on changes, events, and activities that have happened in the five years since the 2002 assessment. It examines:

- The current state of biodiversity and forest conservation
- The principal actions to conserve tropical forests and biological diversity
- The extent to which actions could be addressed by USAID/Madagascar given current and past programming initiatives and experience

This ETOA update will provide USAID/Madagascar with facts and analyses about biodiversity and tropical forestry conservation as the Mission enters its next planning period. The update is intended as a tool for USAID/Madagascar to integrate environmental concerns into its programming portfolio in the short- and medium-term future. This report also provides the information for USAID compliance with Sections 118 and 119 of the U.S. Government Foreign Assistance Act (FAA) of 1961, as amended (see Annex B), to guide and inform USAID/Madagascar as it develops its Operational Plan and Country Assistance Strategy. Annex C is the environmental analysis that addresses the FAA's tropical forests and biodiversity directives.

Lesser horned chameleon at Andasibe

It is important for the reader to note that this update builds on thoroughly researched facts in the 2002 ETOA. Although this report includes sections of the 2002 document, it does not re-state findings; it points out where changes have occurred and new and significant actions and changes that have had, or are having, an impact on biodiversity and tropical forest conservation during the intervening five years.

1.2 Methodology Used for this Assessment Update

This update was conducted in Madagascar by a team of five specialists in February 2008. (Short biographies on the team members can be found in Annex D.) The USAID/Madagascar Mission Environmental Officer provided valuable background information and accompanied team members in field visits on numerous occasions. USAID/Madagascar's Environment and Rural Development Team Leader provided key background information and advice to the team.

Local produce at a street market near Ft. Dauphin

Using the tasks outlined in the SOW, the ETOA team developed a preliminary work plan and schedule. This was approved by USAID/Madagascar and modified following the team's initial discussions and briefings. Half-way through the three-week in-country visit, the team provided an update on the field activities to USAID Mission personnel; this was complemented by an exit briefing at the end of the visit. These meetings were used to inform USAID about the team's findings and for the Mission to provide advice and commentary on the team's actions and research.

During its three-week presence in Madagascar, the ETOA update team reviewed background documents, interviewed key informants in the environmental community in the capital, Antananarivo, and conducted field site visits to four separate areas: Moramanga, Fianarantsoa/Ranomafana, Taolagnaro, and Toliara. A complete list of the persons consulted/interviewed appears in Annex E.

The interviews and field visits enriched, confirmed, and raised additional questions about the information reviewed in background documents and reports. All of these experiences were used by the team to craft an initial draft report that was reviewed by USAID/Madagascar. Comments and edits from the review process were then incorporated into the final draft of this ETOA update.

1.3 ETOA Update Report Organization

This report provides the background and details for the FAA 118/119 Environmental Analysis for Madagascar (Annex C of this document). Following this introduction, data pertinent to the environmental sector are updated (Section 2), and significant changes in the Government of Madagascar's approaches to biodiversity and tropical forestry conservation are noted. New programs and policies (and/or changes in old ones) that impact the sector are briefly summarized along with legislation that has appeared since the 2002 ETOA.

Section 3.0 provides an update of the overall status of natural resources in Madagascar. Key threats to biodiversity and tropical forestry conservation are identified and any changes in the list that have occurred since 2002 are noted. Suggested actions to address these threats are part of the discussion.

An analysis of past and current initiatives in the sector that impact conservation, protection activities, and rural livelihoods that rely on terrestrial and marine resources is presented in Section 4.0. These focus primarily on USAID's investments, but the discussion includes government programs, private sector work, and activities reliant upon NGO direction, funding, and management.

Building on the information discussed in the previous chapters, Section 5.0 presents arguments and opportunities for continued USAID investment in the sector. And, based on the ETOA team's analysis, suggestions are made about specific entry points where this involvement can happen.

Following brief concluding remarks (Section 6.0) the reader can view the primary references and citations used by the ETOA team for this update along with supplemental information (e.g., IUCN Red List, CITES list, maps) contained in the Annexes F, G, and H.

2.0 UPDATING THE CONTEXT

2.1. 2002 ETOA Background

2.1.1. Biophysical Context

Madagascar is the world's fourth largest island and an island continent. It is 1,600 km long, up to 500 km wide, and has a surface area of 587,000 km^2, making it a little larger than France. Its coastline of 5,000 km is fringed with some 260 small islands.

Now lying an average of 500 km from the East African coast, Madagascar originally formed part of the Gondwana super-continent. The joint land mass made up of Madagascar and India then broke off from the African mainland around 180 million years ago during the late Middle Jurassic period. Madagascar split from India around 80 million years ago in the Late Cretaceous period and has since occupied its present solitary position in the Western Indian Ocean.

Madagascar is made up of an ancient Pre-Cambrian crystalline basement in the form of a lozenge aligned southwest-northeast, which has been tilted to create an escarpment along its eastern edge, and overlaid in the west by millions of years of accumulated sediments in the west forming a western sedimentary plain. The continental shelf is mostly narrow and steep in the east with a shallow shelf sloping in the west. The eastern side is bathed in moist trade winds, while the west is mainly dry and the southwest arid, all of which create a large range of climatic conditions and diversity of habitats.

Due to its isolation, Madagascar has developed a unique fauna and flora derived from forms present on the island at its separation and from numerous subsequent accidental colonists. It is best known for the lemurs, primitive primates related to the bushbabies of Africa that have diversified into numerous forms (more than 32 taxa), some already extinct. Similar patterns of radiation are known for the birds (vangas), and, indeed, for many other plant and animal groups. The level of endemism of the native flora and fauna is high – an average of about 80 percent for all taxa at the species level, with many genera and even families unique to the island. Referred to a "laboratory of evolution," Madagascar is one of the world's mega-diversity countries and Africa's highest conservation priority.

2.1.2 Human Context

Madagascar was first settled by humans around the 2nd century AD, in scattered settlements along the west coast. Earliest east coast settlements date from the 5th century AD, and the earliest settlements known from the highlands date from the 7th century AD. While settlement has been dominated by Austronesian peoples originating from the Borneo region, Madagascar has also been settled at different times by people of African, Arab, Chinese, and European origin, generating considerable ethnic variation.

Although well known to Arab traders since before the 9th century, Madagascar was first visited by Europeans (Portuguese) in the 16th century. Until the end of the 18th century, European settlements were limited to coastal colonies and trading posts (notably in the southwest and northeast). Madagascar was united under the first king of Madagascar around 1800. There followed a period of primarily French and British influence until colonization by France in 1896. France abolished the monarchy and the teaching of English and developed

Madagascar as a French-speaking colony. Madagascar gained independence in 1960; since then it has evolved into the republic of the Malagasy people.

Human clearance and use of land in Madagascar comprises two basic tendencies — the Austronesian tendency based on clearance for rice growing, raising pigs and chickens — supporting dense human populations — and the African tendency based on the pasture of herds of cattle and annual grassland burning — where there are sparse human populations. Human occupation typically brings about extinction of the large fauna — Madagascar has lost giant birds, lemurs and other fauna since humans' arrival. Both types of land use are highly destructive ecologically, resulting in a loss of around 80 percent of the country's original forest cover.

Human population and migration

According to the World Health Organization, Madagascar's population in 2000 was of 15,970,000, growing at an average rate of 2.9 percent per year since 1990.

The population of Madagascar is mainly concentrated in the central highlands (about 75 percent) with the highest densities occurring south of Fianarantsoa along the east facing slopes.

In the west, populations are sparse except in the big coastal towns, which now account for about 10 percent of the total population. Human migration in Madagascar has not been systematically analyzed. The principal zones of out-migration are the southeast (where population densities are high and lands are deforested and exhausted) and the far south, which suffers from drought. The principal in-migration zones are to the capital, the large coastal towns and, generally, to the northwest, far north, and northeast. In addition there are seasonal regional migrations induced by seasonal activities, such as shrimp fishing and sugar cane harvesting.

Among the greater migratory pressure points in Madagascar from a biodiversity standpoint are: 1) all of the eastern rain forest corridors; 2) the zones around the coastal towns, particularly Toliara and Toamasina; and 3) the whole of the northern tip of the island from Mahajanga across to Mananara and the Masoala peninsular and north to Antsiranana.

Economic context

Madagascar is today one of the world's poorest countries with GDP per capita of around US$260; its total estimated GDP in 2000 was US$4,020 million, compared to the United States' with US$9,882,842 million, and to France' with US$1,286,252 million.

Madagascar's economy is based primarily on the extraction of renewable and non-renewable natural resources and subsistence agriculture. Eighty percent of the population is rural and dependent on the surrounding environment for food and resources. The principal industries generating US$673 million or 17.7 percent of total GDP in exports in 2000 are agriculture — cash crops such as vanilla, cloves, pepper and coffee represented 17 percent of export value, while fisheries, tourism, mining and export processing zones clothing production make up 40 percent of total export value. (IMF statistics, 2000)

2.1.3 Environmental policy and institutions

Laws

Madagascar has ratified most of the major international environmental conventions including the Algiers Convention on the Conservation of Nature and Natural resources (Law 70-004), the Convention on Biological Diversity (Law 95-013), the International Convention on Trade in Endangered Species (CITES) (Law 75-014), the Ramsar Convention on Wetlands of International Importance (Law 98-004), the World Heritage Convention (ratified 9/12/82), the UN Convention on the Law of the Sea (ratified in October 2000) and the Climate Change Convention (Law 98-020). Of particular note is that Madagascar's protected areas system is currently based on the direct application of the Algiers Convention of 1968.

Madagascar's principal national law and policy on environment is the National Charter for Environment (Law 90-033) which lays down basic environmental principles and promulgates the national environmental action plan (NEAP) and its three successive five-year phases (EP1, EP2, and EP3). The Charter requires EIA for all investment projects, which has been implemented through successive decrees and regulations on compatibility of investments with the environment known as "MECIE" (the current version being Decree 99-954). The Charter is noteworthy in that it pre-dates the Biodiversity Convention, but is based on similar principles. Madagascar may thus be considered a leader in this sense.

Other key laws in the environmental sphere include wildlife laws under the forestry legislation (e.g., Ordinance 60-126) and dependent regulations (notably Decree 88-243 that lists protected species), the law on transfer of management of natural resources to local communities known as GELOSE (Law 96-025) and the decree permitting relative securitization of land subject to GELOSE contracts (Decree 98-610). There is also a new law on industrial pollution. A draft consolidating law on protected areas (known as COAP) has been approved by the National Assembly but has met with technical problems at the level of the Senate that remain to be resolved.

Policies

Apart from the Environmental Charter itself, the key policies relevant to environment are the national policy on forests (Decree 97-1200) and the national biodiversity strategy — negotiated during 2001 but not yet legally decreed. The elements of a policy on coastal zones have also been negotiated, but the instruments remain to be drafted. The majority of sectoral policies now include environmental provisions (e.g., mines, industry) but some remain to be fully "environmentalized" (e.g., fisheries). A further key document is the National Plan for the Management of the Protected Areas (Plan GRAP).

Institutions

The institutional framework for environment has evolved over the years and is now relatively complex. The first higher environmental body to be created was the National Council for Nature established in 1984. Upon launching the NEAP, a new National Environment Office (ONE) was created, initially attached to the Prime Minister's Office with the mandate to coordinate implementation of NEAP. Subsequently a Ministry for Environment was created, which became the overarching authority on environmental affairs to which ONE became attached. The Ministry of Environment has the mandate to implement the national

environmental policy while the sector ministries (forests, fisheries, livestock, transport, mines, energy, etc.) retain sovereignty over development of their respective sectors.

ANGAP (National Protected Areas Management Association) is the institution created in 1991 with the mandate to develop and manage the national protected areas network under powers delegated under forestry legislation. However, bringing charges for breach of park rules still requires the agents of the competent ministry (forest or fisheries).

Other bodies include the National Council on Environment (CNE), which is primarily a consultative body attached directly to the President's Office. The CNE has a non-executive, consultative role and comprises membership colleges, including the private sector, rendering it potentially a highly influential body but one that is not yet fully exploited. There is also an Interministerial Committee on Environment (CIME) chaired by the Minister of Environment, which meets infrequently.

The current status of the Ministry for Environment is unclear. The new government led by the popularly proclaimed president, Ravolomanana, has restructured the ministries, integrating environment with transport, forests and tourism, with environment being at the level of directorate. While the status of the new ministries is politically in dispute, the World Bank and IMF had already stipulated that the number of ministries should be drastically reduced from the existing 32 to 12. Thus, it is likely that the environment will not be returned to the level of full ministry. One potential advantage of the re-structuring is that forests and environment now come under the same ministry, facilitating the management of forests as a priority for biodiversity conservation rather than as a traditional, productive, sector. Fisheries, on the other hand, will be grouped with livestock and agriculture, reflecting its perceived status as a productive sector.

2.1.4. Overview of environmental programs and initiatives

National Environmental Action Plan (NEAP)

The National Environmental Action Plan (NEAP) as defined in the Charter for the Environment and subsequent texts and as manifested by the three five-year phases (EP1 1992-1996, EP2 1997-2002, and EP3 2003-2007) constitutes the principal current environmental program in Madagascar. The program is coordinated by the National Environment Office (ONE) under the aegis of the Ministry for Environment.

Programs 1 and 2 of NEAP each comprised a number of components, with each component assigned exclusively to one of the recognized NEAP implementing agencies (AGEX), with no unifying framework other than the charter itself. Phase 3 is being planned using a more rigorous results-based approach, in which a comprehensive logical framework is first defined before attributing activities to particular agencies. To promote greater integration with other national programs, EP3 adopts as its higher-level objective the national goal of poverty reduction, and intervenes primarily at the level of the Commune in common with the rural development program (PADR).

During EP1 and EP2, environmental activities implemented otherwise than by a recognized AGEX have not been treated administratively within NEAP. Examples include the three principal environmental support programs of USAID – MIRAY (support to protected areas), PAGE (support to environmental policy) and LDI (Landscape Development Initiative)

contracted out to private sector operators. LDI, in particular, is regarded by the EP2 machinery as *outside* EP2. Under EP3, such activities, assuming they matched with elements of the EP3 logical framework, should be regarded as part of NEAP, irrespective of the implementing agency.

The content of the NEAP/EP program will be described in detail in Section III of this report. NEAP and the EPs implement the Charter for Environment. EP1 focused primarily on putting in place institutions for environment (ONE, ANGAP, Ministry of Environment). The "direct" (i.e., on the ground) components of EP2 have focused on approaches and tools for sustainable environmental management, including the regional/spatial approach to management (AGERAS), protected areas and ecotourism (CAPE), community-based management (GELOSE), integrated coastal management (EMC) and rational forestry management (EFSUM).

Conservation Poster at Ft. Dauphin Airport

In EP3 the focus will be on mainstreaming the tools and approaches for environmental management (AGERAS, GELOSE, and EMC) and integrating them with development activities, notably by adopting the same framework of intervention as the rural development program (PADR) in priority intervention zones (ZPI) important for biodiversity. Environmental policy activities will continue at a central level, mainly through the National Environment Office.

Environmental initiatives outside NEAP

As noted above, up until now NEAP has been considered to include only activities defined within a program component and implemented by an AGEX. Examples of environmental activities outside NEAP include a substantial number of conservation initiatives undertaken by NGOs both national and international. Thus, the initiative of a number of NGOs to help Madagascar ratify and implement the Ramsar convention proceeded without reference to EP2. Other examples include the environmental education program of WWF, community-based conservation programs of the Durrell Wildlife Conservation Trust (DWCT) and numerous minor initiatives.

Under the results-based approach of EP3, the NEAP should acquire a more open, pluralist nature, with all operators having the opportunity to contribute to EP3 and influence implementation. Furthermore, agencies formerly limited to activities within NEAP, such as the National Association for Environmental Action (ANAE) and the new NGO Support Services to Environmental Management (SAGE – recently split off from ONE) should also be free to act as operators within the framework of the rural development plan (PADR).

2.2. An Overview of the Key Changes in the Context Since 2002

In its introduction the 2002 ETOA provided USAID/Madagascar with facts about the biophysical, anthropological, economic, and institutional context for reviewing threats to

biodiversity and tropical forestry conservation. That review also provided the backdrop from which the opportunities could be analyzed. Much of that same information remains pertinent as this report is written in 2008. This section highlights the significant changes in that context that have occurred in the last five years (2003-2007). Additional details of the changes are elaborated in other sections (Sections 3 and 5) of this report.

In the past five years Madagascar has experienced a number of events and actions that have had, and are continuing to have, a definite impact on activities related to the nation's environmental conservation efforts. The most significant among these include:

- The government's commitment to triple the size of Madagascar's protected area territory, both terrestrial and marine, to six million hectares
- Decentralization of government institutional decision-making to 22 newly delineated regions
- Instituting economic and environmental change through a more holistic approach outlined in the Madagascar Action Plan (MAP) (see Box 2.1 below)
- An increased awareness and calls to action affected by the increasing international focus on the potential impacts of global warming
- A significant increase in commercial mining activities, and an overall increase in the government's issuance of exploratory permits for minerals and petroleum.

Box 2.1 The Madagascar Action Plan (MAP)

To accelerate and better coordinate the development process, the Government of Madagascar, under the leadership of President Marc Ravalomanana, has created the Madagascar Action Plan (MAP). The MAP is an aggressive, five-year plan that establishes direction and priorities for the nation from 2007 to 2012. It states the commitments, strategies, and actions intended to ignite rapid growth, lead to reduction of poverty, and ensure that the country develops in response to the challenges of globalization and in accordance with the national vision — Madagascar Naturally and the UN Millennium Development Goals. Eight separate, yet interrelated, commitments form the backbone of the plan. Each commitment is comprised of challenges with separate goals and objectives that in turn have indicators to measure progress and the attainment of the established goals. The eight commitments under the MAP are:

1. Responsible governance
2. Connected infrastructure
3. Educational transformation
4. Rural development and a green revolution
5. Health, family planning and the fight against HIV/AIDS
6. High growth economy
7. Cherish the environment
8. National solidarity

Source: **http://www.madagascar-presidency.gov.mg/MAP**

These changes have immediate and far-reaching implications for how the country protects, conserves, and plans its development vis-à-vis biodiversity and tropical forestry conservation. More importantly they are additional layers and wrinkles to conditions that have existed before and since the 2002 ETOA; since then, the conditions are no less important today than they were at the time of the last assessment, which include:

- The extraordinary richness of Madagascar's biodiversity resources
- The continued very high interest and investment in forest and biodiversity conservation activities
- An extremely significant need for rational rural development and economic stability
- An acute need for the vast majority of the Malagasy population for food security and for affordable energy, mainly in the form of fuel wood and charcoal
- A high demand nationwide for potable water sufficient for everyday needs

Behind these context changes that pertain to the environment are other statistics that have direct impact on the sector. Madagascar's population continues to grow at a very rapid rate, 3.008 percent. If this continues, the current population of approximately 19,500,000 (CIA, 2008), will double in 15 years. The majority (85 percent) of the Malagasy people continue to reside in rural areas and depend on agriculture (73 percent) as the principal source of livelihood.

Economic indicators, with ties to environmental events and activities, for late 2007 (IMF, 2008) have shown a flat and slightly weakened trade balance despite a slightly stronger export performance by export processing zone companies. Cyclones in 2007 dampened vanilla exports and over-fishing has negatively affected shrimp exports as well. The start-up of two large mining projects is expected to offset some trade balance effects. The government is optimistic that the mining sector will grow and bring in significant tax revenues.

2.3. National Strategies

Changes in ongoing national programs, organizational structure, and the addition of programs have occurred since the 2002 ETOA.Water and forests were combined with environment in late 2002, and then in 2007, tourism was added. The official name is now the Ministry of Environment, Water and Forests and Tourism (MEEFT). Fisheries, livestock and agriculture have also been combined under one ministry. Other institutional changes are summarized briefly in this section.

Decentralization and Deconcentration Program through LP2D. Advances in decentralization have been made recently: the government adopted an ambitious Policy Letter on Decentralization and De-concentration (LP2D) in November 2004, which has now been followed by an implementation program covering the years 2007-2008 (World Bank, 2007).

The Ministère de la Décentralisation et de l'Aménagement du Territoire (MDAT) was created in January 2005 and six provinces were abolished and replaced by 22 regions.

The LP2D is supported principally by World Bank funding and is articulated around three pillars:

(a) Consolidating decentralization by putting communes and regions at the core of the decentralization process
(b) Strengthening "services techniques déconcentrés" so that they can better support communes and regions
(c) Improving civic participation and enhancing collaboration between communes and regions on one side, and public and private implementing agencies on the other side.

Programme National de Développement Rural. The PNDR is a capitalization and an update of the PADR (Plan d'Action pour le Développement Rural). It is a guiding document for rural development aimed at reaping broad benefits for rural areas. On paper, it is designed to coordinate and harmonize interventions across sectors in each of the 22 regions (through the Regional Rural development Plans, PDRR). It also aims to assure proper synergy between rural development programs and projects.

It is also tied directly to the Madagascar Action Plan (see below) and relates directly to the MAP's Commitment Nos. 2, 4, 6, and 7.

The principal foci of the PNDR are to:

(a) Promote good governance within the rural development sector
(b) Facilitate the access to capital (funding) and to production factors — land tenure, infrastructures, rural finances, materials/equipments, energy
(c) Improve food security by increasing production or agriculture processing
(d) Valorize the natural resources and preserve the natural factors of production — water, soil fertility, ecosystem ecological functions
(e) Develop markets and organize various fields (filières)

Politique Nationale Foncière (PNF) was created to improve land tenure security in rural and urban areas and to define the government's operations in this domain. It is a strategic framework aimed at focusing on land tenure management in order to encourage:

- Private investment
- Agricultural production
- Sustainable management of natural resources
- The development of "collectivités territoriales décentralisées"

The PNF main activities are:

(a) The restructuring and computerization of land tenure offices
(b) Training and building the capacity of the local populace and authorities — including the implementation of juridical and institutional instruments
(c) Updating land tenure rules and procedures, taking into account the new orientation of the government's decentralization efforts to the regions
(d) Implementing a national program to train people in the domain of land tenure security so that they are effective agents in this field

The National Environmental Action Plan (NEAP), first implemented operationally in 1991 as EP1, has been hailed as the most ambitious and comprehensive environmental program in Africa (Razafindralambo and Gaylord, 2008). The NEAP is now in its third (EP3) and final phase seeking to enhance the coordination among large rural development operations and other programs and projects in roads, rural infrastructure, energy, mining, and tourism. It will close in 2008.

The Madagascar Action Plan's (MAP) Commitment No. 7, Cherish the Environment, builds on the NEAP's 15 years of experience and charts new initiatives and goals. Four focus areas, or challenges, are viewed as opportunities for priority projects and activities. These areas include: (a) increasing the protected areas for the conservation of land, lake, marine and terrestrial biodiversity, (b) reducing the natural resources degradation process, (c) developing the environmental reflex at all levels, and (d) strengthening the effectiveness of forest management. The initial MAP document was initially elaborated as strategies. The most recent update now has more detailed action plans that delineate activities, the task managers and deadlines. Numerous goals are specified within each of the challenge areas and specific indicators have been identified with established 2005 baseline figures and targets for 2012.

In September 2003, President Marc Ravalomanana announced an audacious challenge at the Fifth IUCN World Parks Congress held in Durban, South Africa. That announcement, now known as the *Durban Vision*, was to triple the size of protected areas in Madagascar from 1.7 million hectares to 6 million hectares in five years, enlarging the size of protected areas (PAs)

from 3 percent to 10 percent of the country's territory. Since then, the *Vision* has become the leading plan to establish new protected terrestrial and marine areas in the country. The objective is to conserve Madagascar's biodiversity while taking into account the economic needs, which is the basis of environmental degradation. With the development of the MAP it has become the first challenge under Commitment 7.

Following the Durban Declaration, a process was launched to create a comprehensive Protected Areas System, known as the SAPM (Système d'Aires Protégées de Madagascar) based on the six categories of IUCN. Twenty-two new terrestrial protected areas are candidates to be designated under one of the IUCN categories. (NOTE: The total number of PAs in Madagascar given by each institution is not consistent. ANGAP gives the number as 52, including the six small parks on the west coast that never have had an official status; CI gives the number of 35 national parks whereas most people refer to 44 existing parks.)

Global warming has been increasingly in focus and, in early 2008, was the topic of a workshop to assess its impacts on biodiversity and livelihoods (MEEFT et al., 2008). For Madagascar, global warming will likely be manifested in changes in frequency and severity of cyclones, floods, and droughts, as well as sea level rises that will impact coral reefs and mangroves, areas vital to the livelihoods of coastal populations. It is recognized that global warming (often synonymously referred to as climate change) represents a threat to the biodiversity and people of Madagascar, but it can also be an opportunity. The positive elements may come via sustainable financing of conservation actions and sustainable development through mechanisms such as Reduction in Emissions from Deforestation and Degradation (REDD), Mécanisme pour un Développement Propre (MDP) under the Kyoto Protocol, and carbon offsets. The workshop developed a set of policy and technical recommendations and marked the beginning of a dialog among scientists, government agencies responsible for the MAP, donors, and other stakeholders.

2.4. Legislative and Policy Update

Several changes/additions in laws related to environmental actions have occurred since the 2002 ETOA was written. The most significant among these are noted below.

- Madagascar ratified the Kyoto Protocol on 24 September 2003, and it entered into force on 16 February 2005.

- **Arrêté 4355/97**: Définition et délimitation des zones sensibles. This arrêté states that all of Madagascar's fragile areas need to be considered at any Environmental Impact Assessment. (*Note: This law was not mentioned in the former 2002 ETOA.*)

- **Décret MECIE 99-954 du 15/12/99** – modified by **Décret 2004-167 du 03/02/04** The MECIE Decree – the compatibility of investments with the environment 99-954 du 15 Décembre 1999 – asked public and private investors to conduct environmental impact studies whenever investments are apt to alter the environment. The new law – February 2004 – helped to clarify the types and procedures of Environmental Impact Assessment (EIA or PREE) depending on the size and the location of the activities – whether it was in a fragile zone or not. [Note: The Ministry of Environment, Water and Forest and Tourism is currently evaluating how laws in different sectors take into consideration the environmental dimension. Preliminary comments raised from these

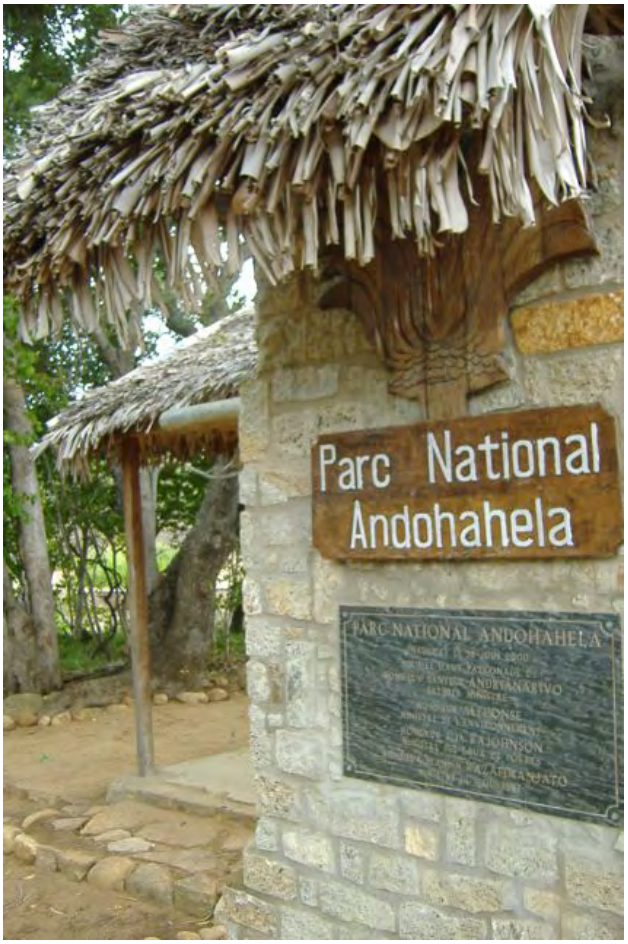
studies pinpoint that the new MECIE disposition is still complex and does not match reality.]

The MECIE Decree is made operational through six Arretés:

- N°18 732 du 27 Septembre 2004, on the definition and the delimitation of sensitive forest zones
- N°19 560 du 18 Octobre 2004, on the "suspension de l'octroi des permis miniers et des permis forestiers dans les zones réserves comme sites de conservation*
- N° 4355/97 du 13 Mai 1997 on the designation of sensitive zones
- N° 6941/2000 du 11 Juillet 2000 fixant les limites d'émission de gaz d'échappement des véhicules automobiles
- N°12 032/2000 du 06 Novembre 2000 relatif à la règlementation du secteur minier en matière de protection environnementale
- N° 6830/2001 du 28 Juin 2001 fixant les procédures et les modalités de participation du public à l'évaluation environnementale

- **Law 2001/05 regarding Code de Gestion des Aires Protégées (COAP)** The COAP classifies the protected areas (PAs) in three categories: Réserve Naturelle Intégrale (RNI), Réserve Spéciale (RS) and Parc National (PN). Its strength rests with the ability of the PA manager or his/her representative to bring into legal and juridical instances anybody caught in infractions. A possible infractions list is given. The COAP allows the creation of a new PA to be included in the national network. For this later case, it is called a voluntary PA, which can be privately managed by individuals or communities.

  The Protected Areas Code (COAP) is being reviewed and the new version will be submitted to the National Assembly. The COAP has been criticized for not addressing several issues, e.g., marine and coastal protected areas; it is likely to be less than adequate in guiding the designation and associated management of future (new) protected areas being created.



Andohalela National Park entrance

- **Décret N° 2005-848 – Création de nouvelles catégories de AP et Procédures** The classification of Protected Areas in the COAP had been reviewed/reclassified to bring them more in line with IUCN protected area categories. These include:

(a) Natural Park (Le Parc Naturel)
(b) Natural Monument (Le Monument Naturel)
(c) Landscape (or Heritage) Protected Area (Paysage Harmonieux Protégé)
(d) Natural Resources Reserve (Réserve des Ressources Naturelles)

This law includes the procedures to create new protected areas and specifies the types of management that can be applied.

- **Law 98. 029, Water Code**, had a number of decrees added in 2003 to improve and protect water sources. Some of these include:
    (a) Décret N° 2003/793 du 15 juillet 2003 that established standards for tapping water sources
    (b) Décret N° 2003-940 du 09 septembre 2003 that set stricter protection zones around water sources
    (c) Décret N° 2003-943 du 09 septembre 2003 set limits and guidelines pertaining to water diversion, water drains, and parameters governing inputs to surface and subterranean water supplies
    (d) Décret N° 2003-941 du 09 septembre 2003 that governs water monitoring and control of water destined for human consumption and establishes access priorities for water resources.

3.0. STATUS OF NATURAL RESOURCES IN MADAGASCAR

3.1. 2002 ETOA Background Excerpts

3.1.1. Forests and Terrestrial Biodiversity

Biophysical setting

Madagascar is an island continent that spans 14° of latitude and encompasses two major global climatic systems. Eastern Madagascar lies in the tropical rainforest belt while southwestern Madagascar lies in the belt of dry climate that runs across the southern Indian Ocean from Australia to Southern Africa. The varied relief and atmospheric systems — trade winds in the east, monsoon in the northwest — generate further climatic subdivisions, at least five recognized principal climatic regions.

Geologically, Madagascar was separated from the Gondwana land mass some 180 million years ago, and later separated from India about 80 million years ago; since then it has occupied its current isolated position. Species assemblages have thus had millions of years to evolve.

Underlying geology also plays a part in determining hydrology and soil type. An assessment prepared by Kew Botanic gardens (DuPuy & Moat 1996) distinguished more than 100 types of primary vegetation based on four principal regions — West, East, Central and South — and 25 sub-regions. In sum, the large variety of habitats, coupled with Madagascar's large surface area and the ancient and varied origins of its flora and fauna, result in an exceptional diversity of species and ecosystems.

Importance of forests for biodiversity

Malagasy forests comprise 4,220 known species of trees and large shrubs. An analysis of the tree flora reveals that 33 percent of the 490 indigenous genera with tree species are endemic to Madagascar, including the Comoro Islands. The 329 non-endemic genera are represented by an additional 3,280 species of trees and large shrubs, of which 95 percent are endemic (Schatz in Lourenço and Goodman, 2000).

Madagascar's flora accounts for about 12,000 species, out of which approximately 10,000 species are forest dependent; 81 to 86 percent of these are endemic. Madagascar alone harbors a higher number of orchid species than does the whole of Africa. A substantial proportion (33 percent) of the native flora consists of trees or shrubs, of which 96 percent are endemic. Most of the remaining native flora is forest-associated.

Dry forests in the southwest comprise more than 1,000 species of which more than 90 percent are endemic (Toliara Biosphere Proposal, ONE 2001). Unusually for littoral vegetation, the dune bush of southwest Madagascar comprises at least 112 species, 95 percent of which are endemic.

With regard to fauna, 3,317 taxa of terrestrial macrofauna have been identified, including mammals, amphibians, reptiles and birds, of which more than 90 percent are forest-associated or restricted (ONE 1999).

Within the mammal taxon, 156 species have been inventoried, including at least 32 lemurs, all of which are endemic. Endemism in other mammal groups is high – insectivores, 97 percent; rodents, 89 percent; carnivores, 87 percent. More than 90 percent of mammals are restricted to forest habitats.

Madagascar has 258 species of birds. While this is a low number in comparison with African countries, 120 of these species are endemic, of which about 100 are forest-restricted.

The reptile category includes 333 species, of which 91.6 percent (305 species) are endemic. Of the 65 genera of reptiles, 60.3 percent are endemic. There are 182 amphibian species in Madagascar (of which 179 are frogs), 98.4 percent of which are endemic. Of the 18 amphibian genera 83.3 percent are endemic to Madagascar. The majorityof amphibians are forest-restricted and most are confined to dense humid forests, such as those found in the southeast (Glaw and Vences in Lourenço and Goodman, 2000).

Table 3.1. Madagascar's forest types, location, proportion of endemic species and biodiversity importance/ecological function of flora within protected areas

Forest type	**Location**	**Proportion of Endemic Species of flora (%)**	**Biodiversity Importance/ Ecological Function Importance**
Low altitude rainforest	East	77	*Extremely high biodiversity importance* Extremely important ecological function
Mid-altitude rainforest	East	73	*High biodiversity importance* High ecological function
Dense dry forests	West	78	*High biodiversity importance* High ecological function
Spiny forests	South, West	More than 90	*High biodiversity importance* High ecological function
Dry forests on Karstic sub-strata	West, Southwest	n/a	*Extremely high biodiversity importance* High ecological function
Mangroves	All major Western rivers mouths	n/a	*Low biodiversity importance* High ecological function
Littoral and sub-littoral forests	Southeast, Northeast, West	n/a	*High biodiversity importance* High ecological function

Source: Adapted from Conservation International and Direction des Eaux et Forêts, 2000

The term ecological function in the above table refers to the ability of these forests to preserve genetic diversity, original biodiversity, and to protect and sustain watersheds.

Economic Importance and Potential

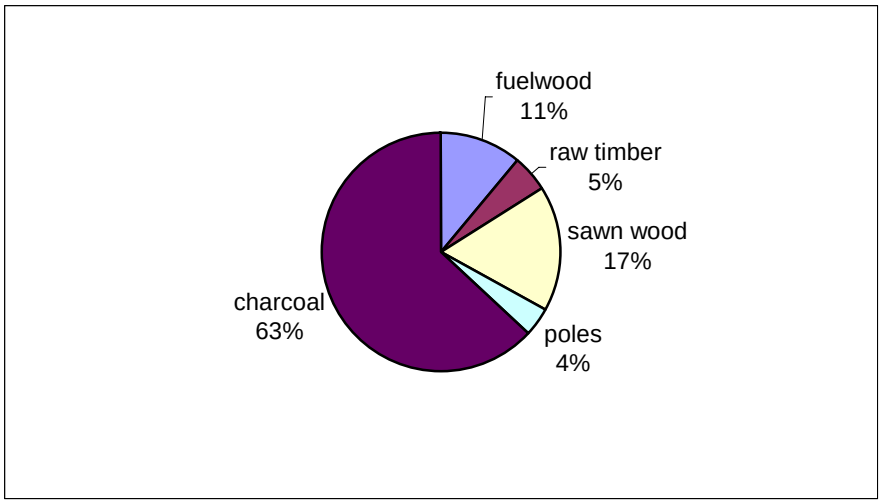
Global Economic Importance of Madagascar's Forests

The existence of a wide variety of forest endemic faunal and floral species confer an extremely high existence value on Madagascar's forests. This high existence value is reflected in international organizations' investment in Madagascar forest conservation throughout the past 20 years. USAID, for instance, has invested approximately US$56.5 million in forest/biodiversity conservation projects (SAVEM, KEPEM, MIRAY, WWF Agents de Protection de la Nature, LDI, PAGE) during the last 10 years. The total investment in NEAP is expected to reach US$450 million by 2008. Economic valuations of tropical forests (Kramer et al., 1995) have shown that people's willingness to pay for preserving these forests is relatively high — ranging from US$24 to US$65 per U.S. household), — and could generate considerable revenues for conservation activities.

Local Economic Importance of Madagascar's Forests

Forests are perceived locally as a source of goods such as fuel, shelter, and medicine. Malagasy people's livelihoods heavily depend on forest resources; it was estimated that in 1998, 96 percent of collected forest products consisted of wood for household consumption, especially charcoal, as shown in Fig 3.1 below. Most importantly, people regard forests as a means to acquire land for the expansion of agricultural production; they usually acquire that land for cultivation through slash and burn (*tavy* in the Malagasy language).

Figure 3.1. Domestic use of forest wood in Madagascar in 1998



Source: Ramamonjisoa, 2000

In economic terms, the total value wood for domestic consumption was equal to US$60 million in 1998 with US$6.6 million for fuel wood and US$36.5 million for charcoal. (Ramamonjisoa, 2000)

At the national level, forest resources are considered a source of foreign currency and energy. Indeed, 75 percent of forest export revenues in Madagascar are generated through the export of timber. However, these export revenues are relatively insignificant and lower than the economic value of forest in a conserved state (CI, DEF, 2000).

Trends in biophysical condition, abundance, and distribution

Biophysical condition

Baobob in bloom

It is only recently that forest indicators have been formulated to monitor biodiversity loss and to evaluate potential impacts of the National Environmental Action Plan's conservation activities on Madagascar's biodiversity. Forest cover indicators reveal changes in the biophysical condition of four main types of forests: rainforest (northeast and east), low altitude rainforest (east), spiny forests (southwest) and dense savanna (west).

For the dense humid forests, figures indicate an average reduction in overall cover of 0.76 percent per annum (F. Hawkins, unpublished data).

Satellite images showing forest cover loss in the USAID priority eastern forest corridors reveal that loss is occurring along the edges of the forest block for Mantadia-Zahamena and Ranomafana-Andrigitra and the edges of the forest block of the Anosibe/Anala-Ranomafana corridor *as well as inside it*. The recent comparative analysis of forest cover loss based on the above satellite images between areas where USAID is intervening and areas where it is not (Hawkins & Horning 2001) reveals that:

- "*Forest is disappearing much more rapidly in areas where USAID is not intervening*." Compared to the USAID priority Mantadia-Zahamena (2.2 percent of cover loss from 1993-1994 to 1999-2000) and Ranomafana-Andrigitra corridors (3.8 percent of cover loss from 1993-1994 to 1999-2000), the control/non-USAID priority corridor experienced a 6.7 percent forest cover loss over the same period.

- *"Forest at high altitudes has also been lost at a disproportionately high rate in the control corridor compared to the USAID focal corridors."*

For the low altitude rainforest, the average yearly rate of change is of 1.53 percent; data is however missing for some of the low altitude rainforests. For the spiny forests, the annual loss is 3.44 percent, making it the most threatened forest type, yet the least represented in protected areas. Dense savannas exhibit a loss of 0.67 percent per annum. (Hawkins and Horning, 2001).

Abundance

Trends in forest loss can be determined through estimations of forest cover over a certain period of time.

A national forest and ecological inventory, the IEFN (*Inventaire Ecologique et Forestier National)* was undertaken between 1994 and 1996. IEFN estimated the remaining forest cover of Madagascar to consist of 13,453,000 ha, covering about 23 percent of the island's land area, classified in three main types of forests or formations — evergreen, deciduous, and other natural forest formations.

A more recent satellite-based estimation of Madagascar's forest cover was undertaken in 2000 by the Joint Research Center (J.M. Dufils in Stiassny, M. & Sparks, J., in press), and produced the following figures (Table 3.2):

Table 3.2. Estimations of forest cover in Madagascar in 1994

Formation	Area in hectares
Evergreen forest	5,532,800
Dry forest	4,118,300
Complex Secondary forest	7,199,100
Mangrove	453,000
TOTAL	17,303,200

Source: Joint Research Center, 1999
in J.M. Dufils in Stiassny, M. & Sparks, J., in press.

Distribution

Deciduous forest formations are scattered in the western part of Madagascar and near the west coast. Dense humid forests are found in the east, and remain the most abundant forests in Madagascar. Dense humid forests include the mid-altitude rainforest of the Central Domain and along the eastern escarpment and low altitude forests, including littoral and Sambirano formations.

Other less abundant humid forest formations, such as the sclerophyllous forests or the sclerophyllous montane formations, are found in the Central Domain. Overall, 10 major forest blocks remain in Madagascar.

Four of the most important forests are located in the east. Two major dry dense and mangrove forest blocks exist in the northwest. Two blocks of dry forests are located in the southwest. The last two remaining forest blocks are found in the southeast of the island: dry dense and secondary forests.

Trends in Management

Historical overview

Historically, the forests of Madagascar have been cleared by humans on a massive scale to make way for agriculture, pasture and wildlife hunted for food, probably causing or hastening the extinction of numerous species of large fauna: giant lemurs, elephant birds, pigmy hippo, among others. Awareness of the conservation value of forests was first officially recognized by Andriananponimerina, the king of Madagascar in the 1780s, who passed a law banning the cutting of forests within the kingdom of Imerina.

At the local level, there is evidence that certain communities living in or close to forests have endeavored to conserve forests and their resources. Examples include the Mikea people of the southwest and the Bara living around Zombitse national park, also in the southwest. There are also examples of local taboos (*fady*) that ban the hunting or harming of certain species such as lemurs, tortoises, and others. However, wherever it is possible to grow rice, or where there is a tradition of extensive cattle raising, the tendency has been to clear the forest, and most large edible species are still hunted throughout most of their ranges.

Following colonization by France in 1896, two phenomena emerged. On the one hand, there was extensive natural history research that led to the creation of the first protected areas and wildlife conservation laws from the 1920s onward. On the other hand, natural forests were quite extensively logged for valuable timber and plantations were established using introduced pine and eucalyptus. Forestry policy was essentially one of production, while conservation was primarily for science. Nonetheless, both approaches required the accurate mapping of forest such that the extent of Madagascar's forest estate became known.

Global concern over the loss of forests and wildlife only began to manifest itself in the 1960s. In 1968 Madagascar signed the Algiers convention on the conservation of Nature and Natural Resources, which provided a framework for creating protected areas that is still used today. This stimulated the creation of new reserves but did little to change the forestry policy, which was still one of production through logging and plantations. During the socialist period 1974-1980, there was little further change.

Major changes finally came in the early 1980s when Madagascar opened to western influence and began negotiations with the IMF for structural adjustment loans. There was a massive increase in the level of biological and conservation research by U.S. and other institutions that have helped to provide baseline information and capacity for rational management of forests and biodiversity. Perhaps the key contributions of the research have been to show:

1. Madagascar's unique terrestrial biodiversity is essentially restricted to natural forests.
2. Madagascar's biodiversity is both more globally important and more threatened than had been realized.
3. The precise location of remaining biodiversity permitted the setting of science-based priorities for conservation.
4. Most of the biodiversity is outside the protected areas network.
5. That conservation of biodiversity cannot be dissociated from human development, especially in predominantly rural Madagascar.

The research has also developed and refined techniques for monitoring changes in forest cover and biodiversity loss, providing the means for evaluating the impacts of conservation action on biodiversity.

In parallel, major advances have been made in approaches to *management* of forest and biodiversity resources.

Prior to the beginning of the national environmental action plan (NEAP), advances were made primarily at the central level of management. A major national congress on Madagascar's conservation was organized by WWF in 1984. Decision-makers became more aware of the issues, leading to improvements in the management of certain protected areas and better control of trade in endangered species (a revised list of protected species was legislated in 1988, Decree 88.243). Deliberations at the national level led to the promulgation of Madagascar's Charter for the Environment (*Charte de l'Environnement*, Law 90-033) that laid the basis for the NEAP and enshrined the principle of conservation of the environment hand in hand with human development.

Current legislation and policy

Madagascar's legislation on biodiversity is based on the following bodies of law – forestry laws, wildlife laws that have been promulgated under forestry law since the 1930s, direct application of international conventions and national environmental law, notably the Environmental Charter of 19990 (law 90-033). Forest legislation is summarized in Table 3.3.

In 1997, the forestry legislation was revised (Law 97-017), and in 1998, a Decree (98-782) defining the terms and conditions of forest exploitation was promulgated.

Table 3.3. Forestry legislation

Issues	Principles
Hunting	• Hunting is allowed on all public or private state properties, except in areas where it is explicitly prohibited (*article 6 and 25* ***Edict No 60-126 of October 3, 1960****).* • Individuals must get a permit from the district forestry officer (Chef de Cantonnement) (*article 10,* ***Decree No 61-093 of 02/16/1961****)* before hunting (this does not apply to local communities' usage rights) (*article 19).* • A special permit for "scientific hunting" can be granted by the Waters and Forests' Ministry in exchange for a fee (*article 15,* ***Decree No 61-093****)*; this allows the hunting of wild animals (protected or not) in natural reserves, national parks and special reserves, and the possession and export of a limited number of animals within a four-month period. • The Ministry of Waters and Forests can grant commercial hunting permits to kill, trap, carry or sell animals and birds classified as "game" during the fixed hunting period, OR to kill, trap, carry or sell pest animals at any time *(article 18 and 19,* ***Decree No 69-390 of 09/02/1996****).*
Slash and burn	• Slashing and burning is forbidden within the national forestry domain *(article3,* ***Edict No 60-127****)* outside that area (on private properties or domanial lands), slashing and burning is also forbidden unless the district forestry officer for the *Fokontany* authorizes it (*article 2,* ***Decree No 87-143****).* • Temporary or indefinite owners of plots of land can be granted a one year, non-renewable and non-extendable *(article 3,* ***Decree No 87-143****)* slashing and burning permit, provided the slope of the concerned plots lie between 20-50 percent and not beyond.
Other types of forest fire	• "Cultivation fires" that burn ligneous vegetation to make way for more land for future agricultural cultivation; allowed without any permit or authorization in areas outside national forestry domain and reforested areas. • "Pasture fires" to clear land for future pasture; allowed in areas outside national forestry domain and reforested areas; requires an authorization (*article 11,* ***Decree No 87-143****);* a safety area of 20 meters around the area to be burnt must be respected, so should limits (*article 17,* ***Decree No 87-143****)*. • "Wild fires" for no purpose are considered criminal (*article 11,* ***Edict No 60-127****)* and are not allowed anywhere.
Forest management	• There are four officially recognized types of forest exploitation (***Decree of 1/25/1930***) : use right (*article 31*), cutting permit (*article 16*), exploitation permit (*article 6*) and special exploitation permit (*article 15*). • Classification of forest lands into forestry, pasture and agricultural lands (***Edict No 62-123 of October 1, 1962***); forestry areas are forbidden to livestock.
Reforestation	• Reforestation is to be carried out in specific reforestation areas (registered by the state specifically for reforestation activities) or on other lands, subjected to the approval of the forestry commission. • Fiscal incentives to encourage reforestation will include state subsidies from the different forestry funds to contribute to land management protection and protection of reforested areas; non-payment of forestry license fees could be another fiscal incentive in exchange of reforestation activities by individuals, communities, etc. • There are five types of reforestation: • industrial reforestation for the production of commercial and fuel wood; • Reforestation for ecological conservation and restoration (of dunes, watersheds, soils, etc.) • Reforestation for social purposes (education, recreation, etc.) • Reforestation for experimentation (with species) • Reforestation for direct economic purposes (agriculture, pasture) • A 15-year reforestation plan is established in each forestry district. The plan is implemented through yearly forests programs (***Decree No 2000-383 of June 19, 2000***)

Source: adapted from ONE, PNUE and ANGAP, 1997

A new forestry policy was elaborated in 1995. Table 3.4 summarizes its main objectives and strategies.

Table 3.4. The forestry policy

Objectives	Measures and Recommendations
1. Mitigate forest degradation	• Find alternatives to *tavy* (slash and burn) • Define a fire management measure with communities • Revise the legislation on fauna and flora management
2. Manage natural resources more efficiently	• Elaborate and launch management plans • Rationalize forest exploitation: attribute plots via public auctions and specifications to sustain forestry resources • Internalize the intrinsic value of wood products in the production costs and overall, improve the management of revenues from forest products • Improve professional skills to avoid waste
3. Increase forest cover and potentials	• Create incentives for reforestation activities • Guarantee land tenure security to individuals engaging in reforestation activities • Plan reforestation programs according to regional and local needs • Intensify activities related to watershed management
4. Increase and improve the economic performance of the forestry sector	• Reflect the value of forest products in a better way (introduce norms for exploitation, exploit a broader range of products, recycle, produce better quality products • Facilitate forest products' access to the market • Develop ecotourism

The Protected Area System

The first protected areas were created in the 1920s, and there are now 47 protected areas made up of 23 special reserves, 16 national parks, and 8 integral natural reserves. These 47 protected areas include 12.8 percent of Madagascar's remaining total forest cover and are all managed by the National Association for Protected Areas Management (ANGAP).

A key objective of the first five-year phase (EP1) of the National Environmental Action Plan (NEAP) was to implement operations of an urgent nature that included protecting the heritage of *biodiversity in the parks, reserves and gazetted forests*, in conjunction with the *development of the surrounding communities* (USAID, 1997). This was reflected in the launching of a series of Integrated Conservation and Development Projects (ICDPs). At this time, ANGAP tended to be considered as Madagascar's leading agency for biodiversity conservation.

However, at the end of EP1, it became more widely recognized that most of the country's biodiversity was in fact outside protected areas in the classified forests. ANGAP's role thus became more focused on the management of national parks, while the role of the Ministry of Waters and Forests – in charge of the management of all the non-protected areas' forests – was given more importance.

ANGAP's mission is to establish, conserve, and manage a national network of parks that are representative of Madagascar's biological diversity. Hence the creation of six targeted eco-regions – North, East, Center, West, South, and an area including unique isolated habitats. A

new protected areas network management strategic plan (known as the "Plan GRAP") was designed for a period of five years (2000-2005) that aims to:

- Conserve the ecosystems that are representative of the Malagasy biodiversity and/or of sites of particular importance using an ecoregional approach
- Classify the protected areas in four priority levels, four being the most demanding in terms of management
- Create new areas
- Optimize the network of protected areas through research and ecological monitoring
- Promote favorable attitudes toward protected areas' conservation
- Promote sustainable development through eco-tourism

Forests Outside the Protected Area System

There are three categories of forests outside PAs: classified forests, forest reserves, and "forêts domaniales" referring to known but unclassified forests in the territory of Madagascar, all of which fall outside the protected areas system and management rules. These forests' areas represent 87.2 percent of the island's remaining forest cover and are managed by the Ministry of Water and Forests (Ministère des Eaux et Forets, MEF).

During the second environmental program, the response to the limitations of ICDPs was to promote and "expand conservation and development activities *beyond national parks and reserves* into a *regionalized landscape [ecology] approach* focused on identifying and protecting key biodiversity conservation zones (e.g. *corridors*)." (USAID, 1997).

The key objectives under this new landscape approach are: to improve governance of the forestry sector, to sustain community-based forest management and, overall, to promote the regional approach to forest and biodiversity conservation.

Community-based management

The first law promoting the management transfer of renewable natural resources to communities was promulgated in September 1996 (Law 96-025), known as GELOSE (Gestion Locale Sécurisée). GELOSE was elaborated in a top-down manner, which has led to difficulties in its application at the field level. GELOSE contracts require facilitation by an official mediator. While this is useful where there are conflicting claims to the resources, such mediation is not necessary for simple cases of management transfer.

In February 2000, the government approved the GCF (or Forest Management Contracts) decree, which transfers the *management of forests to local communities*. The GCF falls under the GELOSE law but emphasizes community-based *forest* management according to a simplified procedure. GCF defined clear forest management plans, annual operational plans, and resource accounting instruments, which GELOSE failed to provide. Through training and support programs, GCF insures the improvement of management and negotiation capacities of communities.

USAID's LDI project has, to date, contributed to the signature of seven GCF contracts in the provinces of Fianarantsoa and Moramanga. Two other contracts are waiting for official approval from the government (A. Abraham, pers. comm.). The USAID-funded WWF/CAF-

APN project has contributed to the signature of 13 GCF contracts, for the management of dense humid forests. It is expected that another 13 contracts will be obtained by the end of 2002 (N. Razakamarina, pers. comm.).

Conservation International, through the USAID-funded MIRAY project, has facilitated the negotiation of nine GCF contracts: Amboasary (1), Miarinarivo (1), Port Berger (1) and Moramanga region (6). Eight other contracts are being negotiated: Port Berger (2), Ambilobe (2) and Ambatondrazaka (4) (B. Delaite, pers. comm).

In December 2001, Josserand performed an assessment of community-based natural resource management in Madagascar, with a focus on community-based *forest* management on six sites in the provinces of Moramanga and Fianarantsoa. (Josserand, 2001) The report concludes that unless:

> current legal and policy instruments are reinforced, the capacity of communities, national institutions, NGOs and donor agencies to follow through the management transfer process is improved, the capacity of communities to manage a commercial activity (natural resources providing the goods for such an activity) is increased…the current rate of transferring resource management responsibilities to communities will not be sustainable.

This raises a key issue about quality – there appears to be tendency to issue as many contracts as possible without regard to the quality of subsequent management.

Improved Governance within MEF

The mid-term review of the second environmental program (ONE, 2000) criticized a lack of transparency and efficiency within the Ministry of Water and Forests (MEF), resulting in the imposition of a series of conditions on potential future debt relief. Continued support to MEF for the remainder of EP2 for EP3 are dependent on compliance with these conditions.

The conditions concern promoting greater transparency, accountability and improved governance in the forestry sector with a special emphasis on:

1. The application and enforcement of decrees defining forest products exploitation in and around sensitive areas, and restricting the export of logs of high-value timbers; in this respect, it is required from the government of Madagascar that it commits to effective legal proceedings against offenders; it is also expected that the inter-ministry committee for the environment (CIME) and the national council for the environment (CNE) will actively apply the above decrees at every level, with support from high levels of government.

2. The set up of a transparent system for the issuance of new cutting permits (this condition also applies to the mining and the fishery sectors); permit issuance should be in accordance with a system of checks and balances with the participation of the ministry of the environment, the regional and local authorities and community-based organizations, as required by the MECIE decree and the forest policy.

3. Improving the management of the national and regional forestry (FFN and FFR) funds by ensuring a transparent monitoring of the collection system, establishing a mechanism for disbursing funds at all levels, merger of the AFARB (action en faveur

de l'arbre) and FFN/FFR accounts such that they are all used to support sustainable forest management.

4. The creation of independent forest observatories (OSF) at the national and regional levels; these observatories would contribute to the monitoring of forest resources' management and the collection of forest taxes. The IRG/PAGE project funded by USAID is planning to implement a governance program, including the creation of regional forest observatories in two pilot regions (Toamasina and Tolagnaro), as well as the launching of a communication program to inform communities, civil society, and others of their rights regarding forestry management.

Kelilalina koloharena water users association interview

Ecoregional approach

One of the most important lessons learned from EP1 with regard to forest management was that "Conservation and development need to continue to be linked in EP2. The ICDPs, however, were very complex to manage and too costly (when compared to the limited population reached) to be considered sustainable." (USAID, 1997). Building on lessons learned from EP1, USAID's conservation management strategy for EP2 sought, among other objectives, to "expand conservation and development activities beyond national parks and reserves into a *regionalized landscape approach* focused on identifying and protecting key biodiversity conservation zones (e.g. [forest] corridors); " (USAID, 1997). The resulting eco-regional, landscape-based approach sought to influence how humans interact with their environment to ensure a sustainable use of natural resources in the broader landscape.

The LDI program was launched in 1998 and set out to promote the sustainable use of natural resources in regions where ecosystems are of vital importance: Fianarantsoa (Ranomafana-Andringitra corridor and Isalo national park), Moramanga (Mantadia-Zahamena forest

corridor), Mahajanga (dry forest), and Antsiranana. In 2001, LDI has assessed the potential contribution of its activities toward reducing slash and burn in four pilot zones: two in Fianarantsoa, one in Mahajanga and one in Moramanga. The forests found in the above regions are dense humid primary forests. The assessment yielded these results (Table 3.5):

Table 3.5. Trends in loss of primary forest due to slash and burn in LDI's priority intervention zones (1990-2001)

Locations	Number of new slashed and burnt plots				
	1990-1993	1994-1997	1998-2001		
Andohanisoa (Fianarantsoa)	33	0	7		
Ranomena (Fianarantsoa)	4	11	5		
Belalitra-Ambalamanga (Mahajanga)	14	11	6		
	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001
Ambalavelo (Moramanga)	1	2	3	4	1

Source: Adapted from LDI and PACT, 2001.

Overall, LDI has managed to mitigate primary forest degradation through slash and burn in the above four pilot zones, located within primary forest areas, appearing to support the regionalized approach.

Zoning

During EP2, the zoning of Malagasy forests was identified as a precondition to launching a national ecological forest inventory (IEFN) and to facilitating management of national forests.

The purpose of zoning is to determine the management mode for different forest blocks, depending on their function — ecological, productive, or regulative. The primary objective of zoning is to delimit forest areas and other vegetal formations and describe their status, potential for development, for conservation, and for enhancement.

In 2001, the multi-donor committee for NEAP (known as CFE) prescribed the zoning of forests as a priority action for MEF, with the aim to:

- Delimitate zones depending on their physical and ecological status and restrict their management mode in accordance with that status.

- Identify zones most appropriate for management transfer under GELOSE; ideally a total zone of five million hectares of natural forest would fall under this category. The immediate objective as of June 2002 is to launch the management transfer of 1.5 million hectares.

Zoning activities were launched. The following results were obtained (Table 3.6):

Table 3.6. Results yielded by the zoning activities in each province (2001)

Province	Management Priority	Area (ha)
Antananarivo	Ecology	588,201
	Production	3,929,037
	Ecology and production	2,569,276
Antsiranana	Ecology	767,998
	Production	225,988
	Ecology and regulation	195,086
Fianarantsoa	Ecology	645,357
	Production	488,436
	Ecology and production	286,321
Mahajanga	Production	1,875,325
	Ecology and production	955,881
	Ecology	677,484
Toamasina	Ecology	1,175,787
	Ecology and regulation	632,161
	Ecology and production	255,970
Toliara	Ecology	2,554,157
	Ecology and production	805,283
	Production	764,994

Out of the results obtained, it is expected that:

1. A map representing the management mode of every single forest block nationwide will be produced.
2. Technical documents including: criteria on the classification of forest resources in relation to their expected role in production, in ecological terms.

Linkages with other resources

Forests protect freshwater ecosystems from sedimentation. It is also the case that many wetlands are adjacent to forests; consequently, the maintenance of forest biodiversity is also a condition for the maintenance of wetland biological diversity.

In relation to marine and coastal resources, forests offer the following advantages:

- Greater potential for eco-tourism when the forest is located near a marine or coastal area, such as in Nosy Be (northwest) or Toliara (southwest)
- Reduced risk of coastal plain flooding
- Reduced risk of dune movement and desertification
- Better regulation of water movement to coastal areas, thus favoring the stability and diversity of mangroves
- Protection of marine and coastal ecosystems, especially coral reefs, through reduced sedimentation

Conservation of forests and terrestrial biodiversity may benefit agriculture through improved irrigation management, longer growth season, maintained rainfall, stable climate, and sufficient supply of resources for farming communities, such as wood and medicinal plants.

3.1.2 Freshwater ecosystems and wetlands

Biophysical setting

Madagascar straddles two major climatic systems. Eastern Madagascar lies in the tropical rainforest belt while southwestern Madagascar lies in the belt of dry climate that runs across the southern Indian Ocean from Australia to Southern Africa. Thus, within one country annual rainfall varies from more than 4,000 mm in the northeast (Masoala, Mananara) to less than 100 mm in the southwest. This large range in rainfall together with variations in physical relief and geology, generate a diversity of freshwater and wetland ecosystems.

Table 3.7. Different types, location, and conservation status of freshwater and wetland ecosystems in Madagascar

Habitat type	Location	Biodiversity importance	Remarks
I. Water courses: rivers and streams	Throughout island	Various	Any human interference affects entire downstream ecosystem; under-represented in PA system
Large rivers	Largest rivers in west	Low importance for aquatic species	Unsuitable for aquatic life because of turbidity; riparian (gallery) forests important for terrestrial fauna esp. in SW
Small rivers and streams	Mainly in central highlands and on eastern escarpment	Important in remote upland forested regions; much local endemism in east	Remote rivers and upper reaches less affected by sediment and exotic species
Underwater rivers (in calcareous formations)	Southwest	Important for endemic blind fish	Little known; low species diversity & productivity
II. Wetlands: lakes, lagoons, ponds, marshes, floodplains, manmade wetlands	Distributed throughout island, especially in west	Western wetlands the most important, especially for birds. Overall endemism of 30%	High diversity of habitats; under-represented in PA system
Continental lakes: Tectonic Plains lakes Volcanic Barrage *Littoral lakes:* Freshwater Alkaline	Mainly in highlands West – Kinkony, Ihotry Manombolomaty lakes Nosy Be Mainly in west E, e.g., Pangalanes canal SW, e.g., Lac Tsinamampetsotsa	Important/vulnerable Important/vulnerable Important/vulnerable Can be important for birds Low species diversity Low species diversity (Ramsar site)	e.g., Lac Alaotra Western Malagasy wetlands (covered in GEF proposal) Sanctuaries for endemic fish Manmade habitat Acid; low nutrient levels Hypersaline
Lagoons (linked to sea)	E and SE – e.g., Anony	Low species diversity	Saline or hypersaline
Marshes	Lake and river fringes, mainly in west	Moderate species diversity; seasonally important cover for birds	Subject to variable hydrological conditions
Peat swamp	Highlands	??	??
Flood plains	Western sedimentary plain, e.g., Tsiribihinina	Moderate importance	Comparatively little studied owing to difficulty of access
Manmade wetlands	Throughout inhabited areas; especially large in west	Moderate importance for birds	Tend to support few species in abundance
Reservoirs (including lakes)	Highlands (town water supplies, lakes for hydro- and other uses)	Low importance	e.g., Lake Mantasoa, lakes near the capital

Habitat type	Location	Biodiversity importance	Remarks
Irrigation plains and rice paddies	Highlands and western areas	Moderate importance in west for birds	e.g., Marovoay area – important for waterbirds
Fish farms (freshwater)	Dispersed throughout Madagascar	Moderate importance for some birds	Support species such as Malagasy kingfisher

Importance of freshwater ecosystems and wetlands for biological diversity

Madagascar's freshwater and wetland ecosystems are of exceptional importance for biodiversity in view of the high numbers of aquatic species and high levels of endemism, particularly in relation to fishes, other freshwater aquatic fauna and the dependence on wetlands of certain endemic birds and global populations of migratory birds. The biodiversity of freshwater and wetland ecosystems is severely threatened, particularly freshwater fishes. However, the comparative lack of information on these systems represents a major impediment to management and conservation of freshwater and wetland ecosystems.

Of the 92 endemic species of freshwater fishes known to date (141 total known species), about 45 are threatened, 20 endangered and 9 extinct, or likely to soon become extinct (Stiassny & Sparks in press). The disappearance of endemic fish species from wetlands or lakes is a widely reported phenomenon (e.g., Watson 1993 at page 26 for the principal lakes in the Manombolo-maty complex) although not systematically evaluated.

The majority of intact freshwater ecosystems occur within or close to remaining areas of primary forest. Thus much of Madagascar's freshwater and forest biodiversity share a common fate (Stiassny & Sparks in press). The volcanic lakes of Mont Passot, Nosy Be island, northwest of Madagascar, and some lakes on Île Sainte Marie (east Madagascar) have so far escaped the introduction of exotic species and are of critical importance for the conservation of certain fish species (CAMP, 2001).

Wetlands in general exhibit a lower level of endemism for birds than forests: 30 percent as opposed to 70 percent for forests (Langrand & Wilmé 1993). Madagascar's wetlands in fact contain one primate taxon, 16 waterbird species, and at least 43 fish species that are found nowhere else in the world.

Western Malagasy wetlands have been identified as an endemic bird area by BirdLife International. These wetlands are the unique habitat of one critically endangered bird, the Madagascar Fish Eagle; two endangered ones: the Sakalava rail and the Madagascar teal; two vulnerable birds: Humblot's heron and the Madagascar plover; and one unevaluated but probably critically endangered bird species: the Madagascar Sacred Ibis. Western Malagasy wetlands support several globally significant migratory bird populations (ZICOMA 1999). The presence of these species and the immediate and considerable threats to them place the Western Malagasy Endemic Bird Area in the highest priority BirdLife category ("critical") for conservation action, making them one of the most important wetland conservation priorities in the world.

For given taxonomic groups of freshwater fauna, Madagascar is often rich in species as compared with Africa. For example, Madagascar has more than 500 species of aquatic insects of the family Trichoptera (caddis flies) whereas middle-Africa has around 200. For the Philopotamidae, 90 species are known from Madagascar, whereas just 15 have been reported for Southern Africa (Gibon, 2000). Levels of endemism are also high – only one of 144

species of mayflies (Ephemeroptera) is not endemic (Elouard & Oliarinony). Further such examples can be expected and are due to the high diversity of aquatic environments and degree of isolation among Madagascar's freshwater ecosystems, especially on the eastern escarpment.

For the fishes, the indigenous Madagascar fish fauna is as species-rich as would be expected from the island's size, with 141 species and 91 endemic species, many of which have highly localized distributions (Stiassny & Sparks in press).

Certain elements of the freshwater fauna show altitudinal variation (e.g., the Philopotamid insects). Thus, species at lower altitudes are especially threatened since the effects of disturbance to water courses are cumulative. The aquatic insect fauna of the eastern escarpment shows a high degree of micro-endemism, i.e., species have very small ranges. In the west, species are fewer in number but more widespread; some are restricted to the middle reaches of rivers where hydrological conditions are more constant (Gibon, 2000).

Economic importance and potential

At the global level, wetlands provide ecosystem services valued at US$14,785 per hectare per year, greater than for any other component of the biosphere by a very large margin. Lakes and rivers come next with US$8,498, followed by coastal zones (US$4,052) and tropical forest (US$2,007) (Constanza et al., 1997).

In Madagascar, wetlands and freshwater ecosystems are important for several economic sectors:

- Supply of drinking water
- Agriculture
- Industrial development: suitable for evacuation of effluents, source of water for processes
- Energy production: (hydropower, cooling water, etc.
- Fishing

Fishing in wetlands can be lucrative for local people. Fishermen on the lakes of the Manombolomaty complex in western Madagascar in 1995 were earning US$1,500 annually or 7.5 times the then-national average (Watson 1997). Such fisheries are principally based on exotic species, mostly tilapia.

However, with the recognized saturation of suitable rice growing land in the highlands, the prime economic importance of wetlands lies in their potential for conversion to agriculture, which poses the greatest threat to the wetlands' integrity).

Trends in biophysical condition, productivity, abundance and distribution

Water courses

Rivers and streams are threatened by soil erosion in most areas. Erosion makes the water turbid and unsuitable for most of the native freshwater fauna and flora. While there exists some estimates of soil loss rates (ONE 1999), flow rates of Madagascar's rivers have been only partially documented (IRD 1999), and no systematic studies of the transport of

sediments by rivers have carried out; thus the data do not yet exist to quantify the turbidity problem.

The ecosystems of rivers and streams are vulnerable to any upstream interference. Essentially only the upper reaches of rivers in preserved forest areas remain intact. In a recent review, it was estimated that up to 9 freshwater species may have become extinct, while 20 are critically endangered and about 45 threatened with extinction (Stiassny & Sparks in press).

Lakes

Madagascar's principal tectonic lake is Lake Alaotra in the northern part of the central highlands, with an area of 22,000 ha and some 20,000 ha of marshes. During flooding, the lakes can extend to 800 km^2; it has been used to irrigate 117,000 ha of rice paddies. Severe sedimentation from hill burning combined with overfishing, agricultural run-off, acidification, (Pidgeon, 1996) and the introduction of exotic species, have altered the lake's ecosystem, resulting in a massive reduction in habitat for species such as the Alaotra gentle lemur, two rare birds — the Madagascar pochard and the Madagascar grebe — and for unknown numbers of aquatic species. The population of Aloatra gentle lemurs has declined from 10,000 in 1990 to 3,000 in 2001. The pochard has not been seen since 1991. Sedimentation has led to drainage problems on the cultivated plains, and fisheries' yields declined from around 3,000 tons in 1990 to just 700 tons in 2000 (DWCT 2001).

Madagascar's principal plains lakes lie in the western sedimentary plain, the major lakes being Kinkony and Ihotry. The plains lakes and surrounding marshes are threatened by conversion to agriculture, pasture, bush fires, overfishing and introduced exotic species. Volcanic lakes are typically deep and steep sided. The principal threats are over-fishing and the introduction of exotic species.

Trends in management

Historical overview

Historically Madagascar's freshwater systems and wetlands have not been "managed," other than to develop them for the usual range of uses — navigation, irrigation, conversion to agriculture and direct harvesting for various resources — including hunting and fishing. In more recent years freshwater systems and wetlands have been used for the supply of drinking water, large-scale irrigation schemes, industrial development, and in energy production.

With the exception of management for a civic purpose — drinking water, irrigation schemes, energy production — use of wetlands has been on an open access basis. As part of the public natural domain under Law 60-009, the possibilities of private or community ownership have been limited. Due to a lack of official awareness, no measures have been taken to limit the introduction of alien species — indeed, many such introductions have been quite deliberate, with devastating effect on indigenous fauna (Sparks & Stiassny in press).

Awareness of the biological importance and ecological vulnerability of freshwater systems and wetlands has come much later than for other ecosystems. Thus, there are still no examples of protected freshwater or wetland ecosystems in Madagascar, while protected forests have existed since the 1920s, and three marine protected areas have been created since 1968. While international awareness raising of freshwater and wetland ecosystems has

highlighted their importance for birds and for ecological goods and services, awareness of the conservation importance of Madagascar's freshwater and wetland habitats has been long to emerge through research. Even the designation of wetlands in 1995 as "sensitive zones" for purposes of EIA legislation derived more from the recognized importance of wetlands for ecological goods and services than from the importance of Madagascar's wetlands for their unique biodiversity.

Legal protection of hunted freshwater species has lagged behind the more prominent terrestrial species. The freshwater turtle *Erymnochelys madagascariensis* has been protected only since 1988. The crocodile has been protected since 1988; it was formerly classed as a pest. No freshwater fish species is protected although it is doubtful that protection would be useful since the threat comes from introduced species.

The designation of wetlands as sensitive zones was the first significant legal step toward their legal protection. The subsequent ratification by Madagascar of the Ramsar convention is undoubtedly the most important step so far. The actions and research of the Peregrine Fund wetlands project and the ZICOMA bird conservation project have helped to define the issues, and the proposed wetlands conservation project by a consortium of organizations led by BirdLife International will be the first of its kind. Finally, the recent CAMP workshop at Lake Mantasoa in March 2001 highlighted the plight of freshwater fauna.

Legislation and policy

Prior to ratification of the Ramsar convention, there was no coherent legislation or policy protecting freshwater systems and wetlands. Lakes and rivers and their banks are legally part of the public domain, discouraging any forms of limited access. Fisheries' texts impose rules about net mesh size for freshwater as well as marine fishing. Certain water birds and one freshwater turtle are protected under wildlife protection laws.

Ratification of the Ramsar Convention on Wetlands represents the most significant legal and policy step for Madagascar, since it obliges the government to designate specific sites in accordance with international standards of protection while undertaking generally to manage wetlands based on wise use criteria.

"Wise use" of wetlands

Wetlands have long been recognized as areas where strict conservation is often neither necessary nor feasible. Instead, wetlands, later followed by coastal zones, are promoted as sites for "wise use" of resources. The emphasis has been on the maintenance of general ecosystem processes to ensure continued provision by wetlands of important environmental "goods and services" valued by surrounding communities such as fish, wood, reeds, waterways and paddy fields.

Community-based management

Thus wetlands projects in Madagascar have been promoting since the early 1990s community-based management using customary rules or *dina* to manage wetlands (e.g., Watson 1993). The new draft law on community-based management of natural resources, Law 96-025 known as GELOSE, was well received by the wetlands conservation groups, (e.g., Watson 1997) although considered overly complex by some who preferred a return to

dina. However, GELOSE offers, through an accompanying land inventory procedure (*Securisation Foncière Relative*) a degree of protection to the land over which resources are managed. Dina can be especially useful to cover large areas under occupation by many different groups. Thus, at Lac Alaotra, a large dina or "*dina-be*" was established in 1998 to close the fishery for two months every year to facilitate stock recovery.

A GEF project has been proposed to conserve Western Malagasy Wetlands – Lower Mangoky, Lower Mahavavy, Besalampy, Soahanina region, Complex Manambolomaty – using community-based management (BirdLife International 2001).

Designation of Ramsar sites and other legal measures

Madagascar signed the Ramsar Convention in December 1998 and it has since been ratified. A national Ramsar Convention committee has been created known as CONARAMS of which 50 percent are NGOs. Two sites have been designated by Madagascar as Ramsar sites – Lac Tsinamampetsotsa and Lac Alaotra. Designation of sites obliges Madagascar to conserve and manage the sites in accordance with Ramsar Convention objectives.

Under Environmental Impact Assessment legislation, wetlands have been designated "sensitive zones." The definition adopted excludes marine areas, estuaries, permanent rivers, temporary rivers, and artificial wetlands, rice paddies, and the like.

Linkages with forests and terrestrial biodiversity

The state of preservation of freshwater systems and wetlands is closely linked to that of the adjacent or upstream terrestrial habitats. Fully intact freshwater systems and wetlands are found only in remote, upland, forested areas. Conversely, certain types of forest are associated with freshwater systems and wetlands although the links are less marked.

The conclusion of the CAMP workshop was that conservation of forests is essential to conserve freshwater and wetland ecosystems while the reverse is not the case. This adds justification to a program that focuses principally on forest conservation.

Biophysical setting

Madagascar lies in the tropical and subtropical marine region of the Western Indian Ocean. Spanning almost 14° of latitude, mean open water surface water temperatures range between 22° and 28° C, with minimum temperatures in August and maximum temperatures in February (Cooke et al., 2000). The extreme south of Madagascar is affected by nutrient rich, cold waters rising from the south. Madagascar's marine and coastal environments may be split into two basic zones – east and west.

East

The steeply shelving eastern continental margin lies in the path of the powerful, westbound, Southern Equatorial Current (SEC) that splits into northbound and southbound branches at latitude 17° S off Cap Est. The shear forces of the SEC have helped to maintain the east coast's rectilinear character. The east coast is also subject to the southeast trade winds, heavy wave action and a narrow tidal range (max. 1 m). The sediment outputs of Madagascar's short eastern rivers are swept away and only a narrow, sandy, coastal plane has developed.

Mangroves are virtually absent and coral reefs have only developed where the separation of the northbound and southbound currents provides partial protection from the current and wave action. The warm waters of the SEC are deficient in nutrients, resulting in relatively low levels of biological productivity in eastern waters, except in areas of nutrient enrichment through upwelling off the Baie d'Antongil in the northeast and Fort Dauphin in the southeast.

West

Sunset at Mangily near Toliara

By contrast, the protected, mainly shallow-shelving, western continental margin, fed by Madagascar's largest rivers, and with large tidal range (3-5 m), has supported the development of extensive estuarine, intertidal and shallow water marine ecosystems as well as a wide coastal sedimentary plane with relatively rich alluvial soils. Affected by the southeast trade winds in the south and the monsoon in the north, with moderate daily onshore/offshore breezes, conditions are favorable for fishing and other marine activities. Zones of high biological productivity occur around river mouths and in areas of upwelling off Maintirano in the northwest and Toliara in the southwest. Thus, it is on the west coast that one finds the greatest abundance of accessible marine and coastal natural resources.

Pelagic and open ocean waters

Pelagic waters refer to those overlying the continental shelf, or about 117,000 km^2 of shelf seas. Due to input from rivers and higher seabed to surface transfer, pelagic waters are generally richer in nutrients than oceanic waters. Biological resources are concentrated in surface waters and near the seabed, or around features such as islands and submerged banks and shoals.

Madagascar's pelagic habitats are ecologically important for many marine species, some of which migrate to shallow water at certain times of year such as sharks, lobsters, and turtles. Still largely unexplored, the deeper pelagic waters and the seabed are likely to harbor considerable economically valuable resources such as green lobster, deepwater shrimp and snapper.

Open ocean waters refer to those beyond continental seas. Relatively empty of life, they are nonetheless important for certain fast swimming species such as tuna that are able to forage over large sea areas, and as migratory routes for large species such as whales and sea turtles. Oceanic surface currents carry the larval forms of most sedentary species, so serve as links between marine ecoregions.

Mangroves, coral reefs and islands

Mangroves

Madagascar has more than 425,000 ha of tidal marshes, of which an estimated 327,000 ha are covered by mangrove forest (Kiener 1972, Lebigre 1990, IEFN 199X). Mangroves thus represent about 2.4 percent of Madagascar's total forest cover of 13.5 million ha. Mangroves are overwhelmingly (98 percent) concentrated along the west coast, mostly (70 percent) in large stands of more than 500 ha at river mouths between latitudes of 13° and 21° S. In addition there are numerous small but nonetheless ecologically important stands in other areas, notably the southwest.

Mangroves provide stabilizing sediments and regulate water flow as well as provide feeding and breeding areas for many species. They support critical life-cycle stages of commercial fishery species, notably penaeid shrimps, which constitute Madagascar's most important industrial fishery — 12,000 tons worth US$93 million annually in 2000. Shrimp catches correlate positively with adjacent mangrove areas (Lhomme, 2000), which are the preferred setting for the installation of large shrimp farms, currently amounting to 1,200 ha (Instat, 2001). Madagascar's western mangroves contain many open, treeless areas, known as *tannes*, permitting the construction of large ponds with little or no mangrove tree loss. The total area of tannes is 50,000 ha (Instat, 2001) with at least 10,000 ha suitable for pond construction; there were 1,200 ha farmed in 2000. Thus mangroves underpin Madagascar's current and future shrimp industry.

Mangroves are important to local populations as a source of wood for construction or fuel, especially close to major towns where mangroves have become degraded. However, due to their capacity for rapid regeneration, certain mangroves offer a potential sustainable source of wood fuel for cities such as Mahajanga, provided they are well managed. Finally, the rapid carbon sequestration rates of mangroves are of interest in carbon credit schemes under the Kyoto Protocol.

Coral reefs

Madagascar has an estimated 3,000 km of coral reef formations distributed along most of the west coast and along the northern section of the east coast. These may be classed as submerged coral banks and shoals, about 1,500 km distributed mainly along the northwestern and western shelf edge and about 1,500 km of emergent fringing and barrier reefs mainly in the northwest, southwest and northeast (Gabrié et al., 2000, Cooke et al., 2000).

Coral reefs provide productive fishing grounds, coastal defense and suitable environments for tourism development. Most of Madagascar's estimated annual inshore finfish catch of 50,000 tons comes from coral reef areas. Coral reefs protect the shore from cyclones, facilitating development of the shoreline and protecting investments. Madagascar's two major coastal tourism areas Nosy Be and Toliara depend on coral reefs.

Islands

Several islands are nesting sanctuaries for sea turtles and sea birds and many are used as seasonal bases for traditional fishermen. Certain islands already make an important

contribution to tourism and many have potential in this area (DEC 2001). Islands and submerged coral reefs help to keep shipping away from fragile coastal habitats.

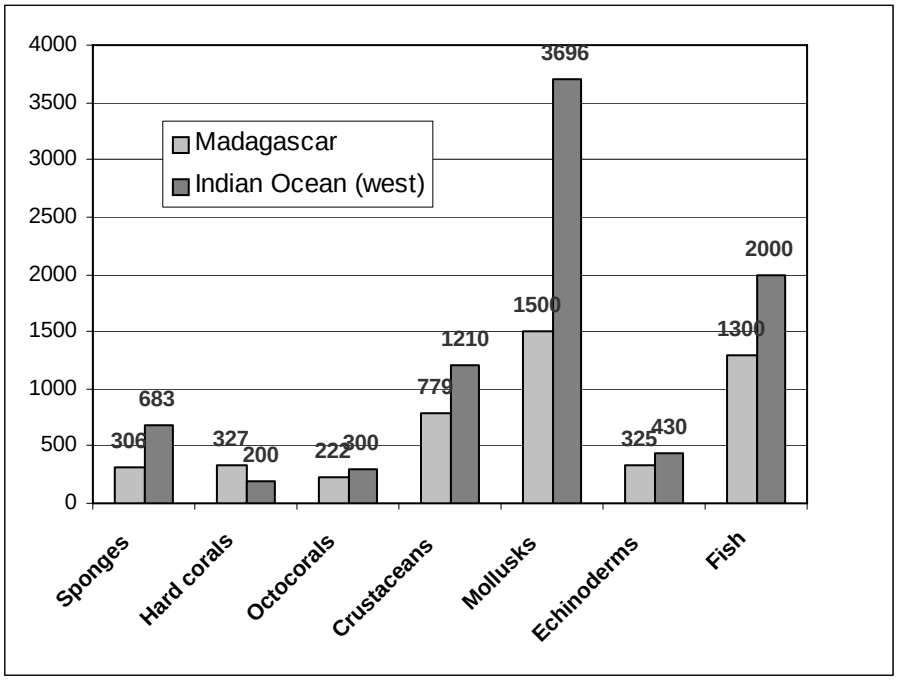
Importance for biodiversity of marine and coastal ecosystems

Tropical marine ecosystems, especially coral reefs, support a vast diversity of organisms. Since most marine organisms are dispersed as planktonic larvae across large distances, endemism is uncommon below the regional level with only a handful of marine species endemic to Madagascar so far recorded. The larger marine species, such as large fish, marine mammals and reptiles, tend to be migratory. Madagascar has just one endemic species of shark (Cooke et al., 2001).

Nonetheless Madagascar is important for marine biodiversity at the regional level because of its large oceanic sea area; the Exclusive Economic Zone (EEZ) has 1,023,000 km^2 of ocean. The country has 117,000 km^2 of continental shelf seas, a 5,000 km-long coastline, numerous small islands and large 14° latitudinal range providing a greater diversity of coastal and marine habitats than any other Western Indian Ocean country. Intertidal and shallow water habitats along the west coast, in particular, cover large areas.

Recent reviews of literature show that Madagascar harbors an average 75 percent of known species of shallow water marine macrofauna for the Western Indian Ocean (Richmond 2001; Cooke et al., in press) (Figure 3.2).

Figure 3.2. Marine macrofauna



Coral reefs are among the most biologically diverse marine ecosystems. Madagascar's coral reefs support a minimum of 6,000 species of macrofauna, probably closer to 10,000 species (Gabrié et al., 2000, Cooke et al., in press). The biological diversity of Madagascar's mangroves has been little studied, although diversity and species composition are comparable to mangroves of Eastern Africa.

Madagascar is a regional feeding and breeding ground for migratory marine megafauna of conservation concern, notably whales and dolphins, the dugong, five species of sea turtles, six species of tuna, large teleost fish such as the sailfish, marlin, and swordfish, and at least 56 species of sharks and rays, notably the increasingly rare sawfish *Pristis sp.* (Cooke et al., 2001).

Prevailing current systems connect Madagascar with its East African neighbors and the Comoros Islands. Madagascar is likely to emerge as an important country for marine biodiversity within the context of large marine ecosystem (LME) management through international cooperation.

In terms of terrestrial species, coastal ecosystems have lesser importance for biodiversity than inland ecosystems, since many coastal species have marine forms of dispersal and are thus regionally distributed. Estimates show that Madagascar's littoral vegetal formations comprise about 21 percent of native endemic species, the remainder being common to the Western Indian Ocean (Bernacsek 1992). However, locally, levels of endemism can still be very high; for example, the dune vegetation of the southwest comprises more than 90 percent of endemic species.

Economic importance and potential

At the global level, coastal ecosystems generate ecosystem services of a relatively high value at US$4,052 ha annually, which may be compared with the open ocean's at US$252), wetlands at US$14,785, lakes and rivers at US$8498, and a tropical forest at US$2,007 (Constanza et al., 1997).

In Madagascar, marine and coastal ecosystems make major economic contributions through fisheries, aquaculture, timber extraction from mangroves, and tourism, while coastal lands are important for agriculture and urban development. It has been estimated that marine and coastal areas contribute 50 percent of national economic wealth (ONE 2001).

Marine capture fisheries in 2000 amounted to about 90,000 tons, with exports valued at US$130 million, or 23 percent of all exports, placing fisheries on a level similar to tourism as an earner of revenues. The total fisheries sector, including continental fisheries, employed some 80,000 people and contributed 7 to 8 percent to GDP in 2000. The government of Madagascar considers marine fisheries, along with tourism and mining, to be a strategic sector for national economic development (Instat, 2001).

The most valuable fisheries export by far was wild caught shrimp, with exports of 12,180 tons valued at US$93 million in 2000, or 71 percent of the total value of fisheries exports. The high importance of shrimp is in part due to the under-taxing, underreporting or poaching of other valuable resources, such as tuna and bill fish such as marlin, sailfish, and swordfish. Considerable improvements in fisheries governance and surveillance are required to secure efficient exploitation of these resources.

Potential sustainable marine fisheries yields have been estimated at about 270,000 tons per year based on a yield of 23 percent of estimated standing stocks (Andrianaivojaona et al, 1992), indicating that current levels of exploitation are running at just one third of potential. However, much of the remaining potential lies in stocks that are of uncertain size and extent or uneconomic to exploit. Readily exploited high-value resources such as shrimp, lobster, sea

cucumbers and sharks are already exploited at or beyond sustainable levels. The potential yields of tuna and bill fish stocks remain uncertain, despite substantial research investments.

Aquaculture in Madagascar is currently limited to penaeid shrimp, sea weeds and the planktonic brine shrimp (*Artemia sp*.) used as food for hatchling penaeid shrimps. Shrimp farming is growing steadily, with five farms covering 1,200 ha and producing 4,500 tons in 2000 (Instat, 2001). Culture of sea cucumbers and certain mollusks is still at the experimental stage. Brine shrimp farming is limited to Ifaty, Toliara, but highly efficient.

Trends in biophysical condition, productivity, abundance and distribution

Pelagic living resources

Information on the state of pelagic resources is limited to the results of acoustic surveys from 1983 (Anon 1983) and subsequent catch data for stocks of interest to industrial fisheries, notably of tuna, other large commercial fish, and deepwater and shallow water shrimp.

Tuna fishery data for the Western Indian Ocean indicate that catches continue to rise with increased fishing effort, suggesting that fisheries still operate within sustainable levels and that the ecosystem is functioning well enough to maintain stocks (Pianet, 1998). No specific assessment has been made of stocks within the Malagasy EEZ. Annual catches of tuna in the Malagasy EEZ have been consistently reported as around 10,000 tons since about 1990, although are unofficially estimated to be closer to 18,000 tons.

There is concern for vulnerable pelagic species, notably sharks, which are taken by catch by industrial long-line vessels (e.g., Cooke et al., in press). Tuna stocks are resilient, due to tuna's rapid growth rate and reproductive mechanism; however, gaps still exist in knowledge about the ecology of tuna stocks in the Western Indian Ocean.

Experience of the EU-funded fisheries surveillance program indicates that tuna and other industrial licensed catches within the Malagasy EEZ are under-reported by as much as 40 percent. Unlicensed catches go entirely unreported. The breadth and reliability of data should improve as the surveillance program progresses and permanent mechanisms for monitoring are put in place.

Shrimp fishery has been studied in greater detail. The shrimp trawler fleet has grown steadily since the late 1960s, reaching 70 vessels in 2000. Since the fleet has grown to 45 vessels, yields have averaged about 10,000 tons, good years correlating with high rainfall (Lhomme, 2000). The fishery is considered to be running at maximum capacity in most areas, with evidence of excessive take-off undersize shrimp in some areas. The major concerns with the industrial shrimp fishery are the large by-catch of finfish and the incidental capture of turtles and sharks. The ecological impacts of bottom trawling have not been studied.

Coral reefs

The most significant studies to date concern the coral barrier reef of Toliara, with biophysical data dating from the 1960s through present day. During this period local artisanal fisheries have proliferated along with other resource uses such as mangrove cutting. Comparative studies of the reef throughout 30 years (Vasseur et al., 2000) indicate:

- 50 percent reduction in the number of coral reef fish species
- 10 percent reduction in area of active reef growth with a corresponding increase of sandy areas
- 50 percent reduction in time required for observers to cross the reef along a transect line due to loss of surface complexity
- 1 percent increase in suspended sediments in the reef lagoon
- 35 percent of the reef top degraded annually by reef gleaners

Observers have noted the disappearance of the characteristic line of boulders along the reef front that increase reef height (Vasseur, 1997). A fisheries study in 1992 indicated that the annual extraction of fish from around the reef was 12 tons, considered to be well beyond sustainable levels for a coral reef fishery, and only made possible by recruitment of stocks from surrounding, less pressured, areas (Laroche & Ramanarivo 1995).

The above are the only reliable, quantitative, data on large-scale biophysical change for a Madagascar coral reef. The Toliara reefs are widely considered to be the most degraded. Reefs around Nosy Be have declined considerably in diversity (Labouthe & Maharavo undated).

Recent surveys of reefs in the northeast (Masoala, Mananara), northwest (Sahamalaza, Nosy Hara) and the southwest (Ifaty), provide usable baselines for future monitoring of biophysical change in those areas (e.g., Randrianamantsoa & Brand 2000, McClanahan & Obura 1998, Maharavo, Randrianamantsoa & Brand 2001).

A pilot reef monitoring program initiated by a regional environment program of the Indian Ocean Commission (PRE-COI), continued with follow-on financing from GEF until 2004. The program carried out transects at several sites. Results appeared to indicate improvements at two sites in the northwest, especially in one protected area, but declined at sites affected by coral bleaching in 1998 (NE, SW) (Maharavo 2000). The sampling effort was insufficient to provide statistically significant indications of change. A preliminary study of Landsat 7 images indicated that satellite imagery might be useful for monitoring Malagasy coral reefs with substantial reef flats (Barde 2001).

Mangroves

The mangroves of Madagascar have been described and mapped in some detail by Kiener (1972) and Lebigre (1990). For those mangroves mapped in detail — the mangroves of Toliara described in Lebigre 1997— these studies can provide a very useful baseline for monitoring biophysical change.

Degradation of mangroves is well documented only for the Toliara region (Lebigre 1997, WWF 1993), although there are numerous examples of mangrove degradation or even destruction near to urban areas, for example, at Nosy Be.

There is some evidence of mangrove evolution in response to the transport of sediment in rivers. In particular, “old growth” biologically diverse mangrove has disappeared while pioneer mangroves have been established on new banks of sediment (Be-Totozafy, 1994). Thus there are indications of a decline in mangrove “quality” due to sedimentation.

Trends in management of marine and coastal resources

Historical overview

Prior to colonial times, there was essentially no conscious management of marine and coastal resources although customs and traditions may have influenced patterns of exploitation.

Following colonization, the first fisheries legislation was introduced to regulate commercial exploitation of high-value marine species — whales, sea cucumbers, sea turtles, pearl oysters, lobster, sponges — and to provide basic controls on ordinary fishing such as minimum mesh sizes. Most of these early regulations are still in force today (Beurrier, 1982).

With the acceptance of the 200-mile Exclusive Economic Zone (EEZ), developing countries received support to evaluate their marine resources. FAO's estimates of sustainable yields of Madagascar's fisheries from the early 1980s (Anon 1983) indicated a maximum sustainable yield (MSY) for all stocks of around 300,000 tonnes annually (Andrianaivojaona et al., 1992) which at the time was around five times the actual yields. This has encouraged the view that stocks are not in danger of over-exploitation and a policy of developing fisheries as rapidly as possible, especially "under-exploited stocks."

The above views have begun to change. At the national level, recognized declines in catch per unit effort of shrimp, and a decline in the catches of lobster have highlighted the need for restraint. At the local level, resources have become highly depleted in areas of intense fishing pressure, especially around Toliara, and for high-value resources such as sea cucumbers, certain mollusks and sharks. While fishers have responded through diversification and range extension, the first examples of conflict over marine resources have emerged. Scientists and conservationists have added to concerns by highlighting local species declines and ecological degradation (e.g. Vasseur et al., 1988; Vasseur, 1997; Gabrié et al., 2000).

Current legislation and policy

Legislation on marine and coastal ecosystems comprises fisheries legislation, protected species, forestry texts relating to mangroves, decrees and orders creating marine and coastal protected areas, EIA legislation and miscellaneous texts concerned with regulation of extraction of the public domain, e.g., beach sand and corals.

Fisheries legislation is based on an original decree of 1922, under which most technical regulations have been passed. The recent fisheries edict (Law 93-022) that defines the overall management regime for fisheries, stipulates in particular that fishing is no longer a free activity but one that can be made subject to licensing and includes a power to create fishing reserves. The law also provides that fisheries should be managed according to principles of ecological sustainability. A sustainable fisheries strategy was commissioned by the Ministry for Fisheries (Orgasys, 1997). However, the draft strategy was never approved or applied.

The legislation for the protection of marine species derives from four principal texts:

- Decree 61-096, under Ordinance 60-126, which provides for protection of certain fauna including whales and dugong;

- Ordinance 75-014, implementing CITES, and subsequent decrees 77-246 and 83-108, which implement CITES Annexes I, II and III;

- Decree 88-243, which extends the list of totally protected species under 60-096 to include (probably) all sea turtles including the leatherback;

- Ordinance 93-022, the fisheries code, which totally protects marine mammals.

In addition, older regulations passed under the fisheries decree of 5 June 1922 or the Code Maritime of 1966 regulate the exploitation of whales, dugongs, turtles, lobsters, pearl oysters, ornamental shells, shells for button making, sponges, edible oysters, sea cucumbers, and algae.

Whereas Law 70-004 approved ratification of the Alger Convention of 1968 for the Conservation of Nature and Natural Resources, which lists dugongs and sea turtles among other protected species, Madagascar has never passed implementing legislation although it has followed the convention in creating protected areas.

As mentioned, sea turtles are listed as protected species in the Alger Convention of 1968 but Madagascar has not passed legislation thereunder. Sea turtles are listed in Ordinance 75-014 as CITES Appendix 1 species, but this only regulates international trade. Decree 88-243 appears to provide that all sea turtles are fully protected and specifically lists the leatherback *Dermochelys coriacea;* the decree creates confusion by classing sea turtles with a freshwater species *Erymnochelys madagascariensis.* Sea turtles also enjoy partial protection under two obscure ministerial orders (*arrêtés*) from 1923.

Madagascar has not included all CITES-listed species in implementing legislation. Decree 77-276 lists in Appendix 1 dugong, cetaceans, and sea turtles, while placing the coelacanth, which is unprotected under domestic law, in Appendix 2. Hard corals, Annex 2 species, are absent from implementing texts and permits for the export of corals have been issued by the Direction des Eaux et Forêts (DEF) in the recent past without prior impact assessment. CITES-listed gastropod species subject to trade in Madagascar are also absent from implementing texts.

Mangrove forests are part of the national forests domain and come under forestry legislation. Few specific texts exist in relation to mangroves, although in certain areas they have been the subject of forestry concessions and cutting permits, notably in the province of Mahajanga. To date, no policy exists on mangroves, although they fall within the broad definition of wetlands under the Ramsar convention. At least one protected area exists with a significant area of mangrove, the national park of Baie de Bali, with others proposed, notably mangroves of the estuary of the Manombolo river.

Mangroves, coral reefs and small islands are all classed as “sensitive zones” under EIA legislation Arrêté No. 4355/97 of 13 May 1997 with the result that EIA is automatic for investment projects that potentially impact these ecosystems.

Decree 64-291 regulates the delimitation, use, and conservation of the “domaine public naturel” that includes beaches, intertidal zone, bays, and lagoons connected to the sea. Extractive activities such as sand mining therefore require a permit. While coral reefs are not

expressly included, the law has been treated by certain authorities as applicable to the extraction of corals.

Marine protected areas (MPAs)

Three protected areas have been legally created that include marine habitats:

- Nosy Tanikely, a small islet close to the island of Nosy Be in the northwest, was declared a marine reserve in 1968 by Arrêté 4730 in the Journal Officiel 2232, 30 November 1968 of the Ministry of Equipment and Communications – Tanikely is also the subject of a decree by the local authorities.

- Biosphere Reserve of Mananara-Nord, on the northeast coast, gazetted in 1989, Presidential Decree 89/216. The reserve, a controlled development zone, extends along 50 km of coast and includes two strict conservation zones with national park status – a circular marine zone (1,000 ha) centered on the islet of Nosy Atafana, and a much larger terrestrial forest zone.

- Masoala National Park, close to Mananara in the northeast, comprises three marine reserves totaling 10,000 ha of coral reef, a lagoon, and open water habitat (Tanjona, Cap Masoala, Tampolo, Presidential Decree 97-141.

A community marine reserve exists at Nosy Ve islet, south of Toliara, created under a customary social convention or *dina* issued in 1999 (Rakotoarison, 1999). This has no formal legal status yet.

The protected areas of Mananara and Masoala were established through direct application of the Algiers Convention of 1968, in common with most of Madagascar's protected areas. The draft law or code on protected areas known as COAP provides for the creation of national marine protected areas.

In 1998 an initiative was launched by UNESCO at the request of the Malagasy government to assess the potential for creating new coastal "biosphere" reserves. A workshop in November 1998 confirmed the suitability of four sites and subsequent studies resulted in one site being formally accepted, the Sahamalaza Peninsular and Radama Islands, and a completed proposal for a second site, the Toliara Littoral Zone. The two other potential sites have been the subject of detailed studies: the Nosy Hara island complex and the Kirindy-Mikea Coast, a.k.a Belo-sur-mer, but no proposal as yet.

Additionally, in December 1999, a national initiative was launched by the Environment and Marine Component (EMC) component of EP2 together with ANGAP, the national protected areas authority, to identify, assess, and create new "marine and coastal conservation areas." This has resulted in a national plan of action,which identifies numerous potential sites, and feasibility studies for a site in the southeast: Lokaro, Evatraha, and Ste. Luce.

Finally, a national inventory of small islands has been conducted that highlights conservation importance and potential of small islands. Some are likely to be proposed as protected areas during Environmental Plan 3.

Integrated Coastal Zone Management (ICZM)

There has been an increased awareness of the ecological links between marine and coastal ecosystems and the potential value of an integrated management approach. An assessment financed by USAID pointed out many of the problems (Jain 1996) and a national workshop on coastal zones in 1996 highlighted the value of an integrated approach. These discussions led to the adoption of a marine and coastal component known as EMC in Phase 2 of the national environmental action plan (NEAP) that aimed to promote integrated coastal zone management (ICZM).

Studies of the Toliara region by EMC in the course of NEAP Phase 2 confirmed the impact of upland erosion, land use, and mangrove deforestation on the decline of coral reefs and the need for an integrated coast/river basin approach to coastal zone management (CNRE/CNRIT/IHSM, 2000). Integrated management plans have been developed for fisheries, mangrove use, and tourism for Toliara and Nosy Be (Ocean Consultant, 2000).

Increased awareness of problems locally and the effective absence of state authorities have encouraged user groups to take the initiative in managing marine resources. The EMC component of NEAP has exploited this tendency with a resulting proliferation in the use of customary social conventions (*dina*) for resource management, typically accompanied by a formal request to government under the GELOSE legislation for a contract to manage the resources.

In addition to the enforcement of size limits on capture, and banning the use of destructive fishing methods such as poison, the value of “no-take” zones, protected areas or sanctuaries as a powerful and simple tool for maintenance of stocks is taking hold and is being applied in several areas. The protection and restoration of degraded mangroves has also been attempted on a pilot scale as a means for maintaining ecosystem processes in support of fisheries.

At the national level, a policy orientation document on sustainable development of coastal areas has been published by ONE through the EMC program, and advocates the integrated approach for Madagascar’s coastal zones (ONE 2001a). Regional and national workshops have been held using the document as a basis for discussion and have yielded a series of recommendations, under which national coordination of CZM would rest with the ministry responsible for environment, while regional implementation would be the responsibility of the autonomous provinces (ONE 2001b).

Considerable doubt remains about the future of ICZM given the subsequent absorption of the Ministry for Environment into the broader ministry of Transport, Tourism, Environment and Forests and persisting questions surrounding the autonomous provinces in the current political crisis. In principle, greater integration of ministries should favor ICZM, while the autonomy of provinces should facilitate establishment of regional ICZM schemes.

Industrial fisheries management

Marine living resources are the responsibility of the Ministry for Fisheries and Marine Resources (MPRH), which is primarily concerned with industrial fisheries that generate hard currency. Initiatives for better management have come from operators and their donor partners rather than from the government. Collected revenues are small in relation to the value of catches.

The principal tuna fishery is a purse-seine fishery operating in the northern waters of Madagascar's EEZ during the first half of the year comprising about 45 Spanish and French vessels. Catches are mainly skipkack (69 percent) and yellowfin (25 percent) tuna, of which an estimated 10,000 tonnes is typically attributed to Madagascar's EEZ, unofficially estimated to be closer to 18,000 tonnes. The EU-financed fisheries surveillance program under MPRH is promoting the installation of transmitters on vessels and fuller catch reporting.

The other fishery is a long line fishery, comprising some 110 licensed vessels from Japan, Korea and the EU operating year round throughout Madagascar's EEZ. Unfortunately, catch reporting requirements are not enforced by MPRH; the fishery is thus essentially unmanaged. Based on an average capacity per vessel of 750 tonnes spending a good part of the year within Madagascar's EEZ, the catch from Madagascar's EEZ is estimated to be at least 50,000 tonnes, comprising mainly tuna, bill fish, and sharks. Limited data collected in the early 1990s indicate that sharks make up 6-10 percent of the catch (Cooke, 1997).

Management of the industrial shrimp fishery, on the other hand, has made major strides in recent years, largely through the efforts of the industry itself. Following establishment in 1994 of an association of industrial fishing companies known as GAPCM (*Groupement d'Armateurs de Pêche aux Crevettes de Madagascar*, recently renamed *Groupement d'Aquaculteurs et des Pêcheurs de Crevette de Madagascar*), the industry has voluntarily accepted management measures including a zoning plan, permit system and satellite tracking of vessels and has proactively promoted scientific research and other supports to management of the fishery.

A moratorium has been called on the issue of further licenses fixing the number at around 70 trawlers. Key sustainability issues to be addressed are the by-catch of sea turtles in trawls and the conflict between industrial trawlers and small-scale fishers over access to the disputed two-mile inshore fishing limit. To address these problems the GAPCM with MPRH has developed a program with financing from the French Development Agency (Agence Française de Développement, or AFD) to put in place shrimp fishery management and development areas (*Zones d'Aménagement Concerté,* or ZAC) which will promote coexistence between industrial and small-scale fishers (CEASM 2000). The same program has funds to help operators install turtle excluders, although one of the larger operators has already done so with its own financing.

Industrial fisheries surveillance

An EU-funded fisheries surveillance program has recently been established as a condition of the tuna fishing agreements between the EU and Madagascar. The program aims to set up a permanent surveillance system and includes:

- Establishment of a permanent dedicated marine surveillance unit free of political control
- Central satellite tracking of all tuna and shrimp industrial vessels
- Periodic aerial and marine surveillance missions, with arrest and seizure of infringing vessels (deterrent function)
- Generalized policing of fisheries texts, from fishing activities through to export trade, retail outlets and restaurants

- International cooperation on the governance of fisheries, especially for tuna and other oceanic fisheries

The program has already had considerable success in satellite tracking, evaluation of the extent of poaching and in making arrests of industrial fishing vessels. Establishment of an independent surveillance agency remains one of the major challenges.

Community-based management of small-scale fisheries

Until recently small-scale fisheries and other coastal resources such as mangroves have been exploited on an open access basis. This is beginning to change where pressures are high or resources are especially valuable. Methods of access control range from unilateral action by an established user group to fully negotiated access arrangements. Thus, in recent years locally declared taboos (*fady*) and customary social agreements (*dina*) regulate access to resources (e.g., Rakotoarison, 1999). Within the framework of NEAP, regional integrated resource management plans have been negotiated, although await application (e.g., Ocean Consultant, 2000). Initiatives are underway to integrate such resource management plans into regional Integrated Coastal Area Management (ICAM) schemes.

Trade monitoring and regulation

While not expressly aimed at resource conservation, the monitoring and control of domestic and international trade in marine products generates data, notably for high-value species such as sea cucumbers, lobsters, crabs, sharks and turtles, which could be useful for conservation and management. Monitoring of marine produce is conducted at the levels of provincial production, health and sanitary regulations, hard currency control and international customs.

Betsileo land use above Ambohimahasoa

Biophysical setting

The land mass of Madagascar comprises a lozenge-shaped basement of crystalline, mainly metamorphic, pre-Cambrian rocks intruded over large areas by granitic igneous rocks and at scattered locations by volcanic formations — lavas, tuffs — which has been overlain in lowland areas by sedimentary series derived from alluvial deposition or periodic marine incursion throughout geological time.

In humid conditions, crystalline and igneous rocks weather into deep tropical ferruginous or ferralitic laterites from which most minerals have been leached, yielding poor, acidic, friable, soils. In dry conditions, laterites do not form, with the result that the crystalline basement is

either exposed or overlain by thin mineral soils. Volcanic formations in moist conditions weather into cohesive basic soils rich in magnesium, an essential element for photosynthesis. The sedimentary series yield a variety of soil types depending on the underlying rock type and environmental conditions.

Types and Location

Soils

Ferruginous and ferralitic soils represent almost 70 percent of the total national area. A further 27 percent of the national territory is characterized by mineral soils in the highlands, western watershed and the far south. The remainder comprises calcimorphic, halomorphic (saline), and hydromorphic (peats) soils.

Ferruginous and ferralitic soils are highly vulnerable to erosion once exposed, as occurs with deforestation. Denudation of ferralitic soils results in the development of grasslands, whose soils are critically prone to hydrological erosion. Erosion results in the creation of *lavaka*, literally "holes," such as those along the western side of the high plateau. The term "lavaka" is now used internationally to describe this type of erosion, which is found in parts of Africa and Asia.

Lavaka formations and the resulting landslides cause siltation of crop fields (rice and others). *Lavaka* continuously deepen, and during that evolution, water and organic matters from the top of the hillside collect at the bottom allowing new vegetation to develop. Undisturbed, the phenomenon can lead to the creation of gallery forest.

Uncontrolled disturbances such as frequent fires and agricultural practices without biological or mechanical anti-erosion measures further increase the vulnerability of ferralitic soils to erosion.

Intense water turbidity and coarse-grained sediment loads on most rivers on the western side of Madagascar are visible proof of the effects of erosion. The impacts are significant for downstream alluvial plain agriculture.

There are intrinsic as well as anthropogenic threats to soils, the most important agricultural resource. The intrinsic quality of ferralitic soils is, in itself, a threat to the viability of agriculture. If combined with exogenous sources of pressure such as slash and burn, threats to soils and agricultural land are significantly increased.

Agricultural lands

Arable lands are notably a small percentage of the whole, whereas pastures consist of more than the majority of total land area in Madagascar.

The total agricultural land area in Madagascar is 368,561 km^2, or 62.8 percent of the island's total area. This agricultural land area consists of:

- Arable land and
- Permanent pasture, grasslands, and savannas (Figure 3.8).

Grasslands and savannas in Madagascar occupy 58 percent of the total area dedicated to agricultural activities (INSTAT, 2001).

Table 3.8. Estimates of the productivity rates of the main agricultural products over the six provinces in 1999 (tonnes/hectares)

	Antananarivo	Fianarantsoa	Toamasina	Mahajanga	Toliara	Antsiranana
Paddy	2.69	1.90	2.035	2.49	1.51	1.81
Cassava	7.036	7.43	8.58	5.53	6.05	4.96
Maize	0.79	1.13	0.93	1.02	1	1.23
Sweet potato	6.69	6.11	4.58	4.8	4.59	3.94
Coffee	0.34	0.34	0.37	0.31	0.29	0.33

Source: Calculated with data from the Service de la Statistique Agricole/DPEE/Ministère de l'Agriculture

Cassava is the most productive staple crop with the highlands and the east coast province of Toamasina as main producers. Sweet potato comes second with the highlands and the south west (Toliara) as the main producers. Paddy rice comes next and is mainly produced by the highlands, western, and eastern provinces. Rice cultivation is intense in the central highlands, yet yields are still low by global standards at 2.69 tonnes per hectare. Maize comes fourth, with the northern, eastern, and highland provinces as the major producers. Coffee is a low-weight cash crop with similar yields throughout. Most is produced in the eastern side of the island.

Livestock

There are seven million cattle, compared to six million in 1995, in the whole of Madagascar with little change during the past 20 years. Cattle raising is threatened by the extension of agricultural area, reducing area for extensive grazing and limiting access to water for drinking.These are the primary causes of stagnation of the livestock sector.

Cattle raising is mainly an extensive activity, requiring periodic grass burning just before rains to generate the desired fresh "green bite." A lack of land tenure rights and a high rate of cattle rustling discourage intensive livestock production, because of the uncertainty about future ownership of pastureland and risk of losing livestock, which is a form of capital in Malagasy culture.

Other events have contributed to the decline in livestock holdings and production.

In 1997 the European community imposed an embargo on the export of Malagasy meat, due to non-compliance with hygiene standards and probably due to lack of demand. A costly new abattoir subsequently constructed in Antananarivo with EU funding has never operated due to political conflict.

The African porcine pest, known for its devastating effects on pig production, severely hit Madagascar in 1997, and worsened the following year. Data from the Ministry of Livestock reveal that in 1998, 275,000 pigs (32 percent) out of 870,000 were lost due to African porcine plague in 1998 (INSTAT, 2001).

Poultry production is the most dynamic livestock sector in Madagascar with 60,000 chicks produced every week; this type of production is increasing in urban peripheries.

Since closure of a World Bank-funded livestock program in 1999, there has been no significant program within the Ministry of Livestock to promote the sector despite its potential.

Livestock production opportunities

Because of high humidity, the eastern region is not favorable for livestock production. Cattle reared in the region are imported from the highlands or the south. They are used as draft animals and for cultural ceremonies and rituals. Extensive household poultry production is predominant.

Highlands

The high plateau is the area of most intensive livestock production. Poultry, pigs and dairy cattle are reared in small-scale household production, but also on semi-industrial to full industrial scale. The highlands have a major potential for intensification and expansion of livestock production due to market access, financial capital and an abundance of small and industrial agro-industries and agro-processors, as well access to grain and tuber production useful as fodder.

The major limitation to livestock production intensification and expansion is population growth that increases competition for cereal foods used for human consumption and cereals for animal consumption. Urban growth also encroaches on former pasture. Expanded agricultural production should favor livestock production in the highlands.

Midwest

The open rangelands of the west, with medium to low population densities, offer attractive conditions for livestock production in that region. Before the African Porcine Pest hit the area severely, pig production was another important livestock activity in the Midwest. Unfortunately, due to weak a marketing structure, repeated contagious diseases, and inadequate vaccinations, the sector's productivity has considerably declined.

Sub-humid west and arid south

The open and vast grasslands of the western and southern region offer an outstanding potential for the production of large and small ruminants. While large ruminant production is orientated toward meat production, small ruminant livestock production is multi-purpose producing meat, dairy, and mohair fibers. Development of ruminant-raising is, however, constrained by two factors: weak or non-existing breeding systems and poor management of free roaming grazing. Additionally, poor grazing practices mean that beef cattle cannot be marketed until the mature age of five to seven years.

Agricultural biodiversity

Agricultural biodiversity, or agridiversity, is a recognized component of biodiversity under the Convention on Biological Diversity. Agridiversity refers to the diversity of plant and animal varieties and species, or agri-species, in actual or potential use in agriculture and includes "agroecosystems" and the genetic resources comprised within "agri-species."

No full inventory or evaluations have yet been conducted of agridiversity in Madagascar. However, the value of Madagascar's agridiversity can be expected to be substantial given the large variations in climate and soil types, encouraging the generation of numerous varieties of economically or genetically useful species. Known examples include a native species of

caffeine-free coffee, two wild rice species resistant to the rice yellow mottle virus (RYMV), a native toxic species of sorghum, and two wild vines resistant to insect pests.

Conservation of agribiodiversity

Objective N^{o} 3 of the National Strategy for the Sustainable Management of the Biodiversity (NSSMB) under the theme "Biodiversity Conservation" provides for conservation of the genetic resources of agribiodiversity in accordance with conservation principles.

Objective N^{o} 4 of the NSSMB under the theme "reduction of pressures on biodiversity resources" provides for the reduction of risks posed by biotechnology and development of biosecurity. The strategy calls for the defense of indigenous agridiversity from threats posed by genetically modified organisms (GMOs) and from introduced species or pests.

Madagascar is a signatory to the biosecurity protocol under the Biodiversity Convention that requires countries to introduce measures to reduce the risks posed by GMOs. However, no specific measures have yet been put in place. Conversely, there are no specific plans to promote the generation of benefits from innovative uses of indigenous agridiversity, although there have been discussions about conducting a full inventory of Madagascar's agridiversity resources.

Conservation of agridiversity is implicit in the objectives of several environmental and agricultural programs, such as the soil conservation component of NEAP Phase 2, the rural development program (PADR) and various projects supported by bilateral donors in the agricultural field.

The principal institutions in Madagascar concerned with the conservation of agridiversity are the national agricultural and plant breeding institute (FOFIFA) and the more recently established national forestry seed bank or *Silo National des Graines Forestières* (SNGF).

FOFIFA's remit is to conduct research into agricultural techniques and plant varieties, usually working on a project basis with partners. It maintains local seed banks in the course of projects but does not maintain a permanent national agricultural seed collection.

The SNGF has a national network of collection points and aims to conserve useful tree species and varieties. At present the SNGF is mainly focused on varieties of introduced species, but is now beginning to stock samples of indigenous tree species. An advice service is offered to those interested in using the species in question.

Economic importance of agricultural resources

Madagascar has an important potential for more intensive, extensive and diversified sustainable agricultural production. It has extensive arable lands, only a small fraction of which is exploited. Its assets in terms of diversified ecological zones would be favorable for agricultural diversification. But Madagascar has not so far participated in the "Green Revolution," which refers to farming with use of fertilizers and pesticides, and partly explains the observed agricultural stagnation.

Agriculture in Madagascar employs 80 percent of the total labor force, of which 68 percent of people are the poorest of the poor. About 75 percent or about two million households derive

their livelihoods from agriculture, which also represents 53 percent of GDP, and cash crop production — vanilla, cloves pepper and coffee — accounts for 17 percent of total exported goods (IMF, 2000).

The rigorously controlled bio-prospecting of agricultural resources, such as some of the seeds guarded by SNGF, could generate substantial revenues, which demonstrates another way in which agricultural resources are economically important.

Trends in biophysical condition and productivity

Figures reveal that overall, agriculture production during the past 15 years has stagnated or decreased in Madagascar, whether it be with regard to staples or cash crops. The decrease in annual production growth rates is shown in the Table 3.9 below.

Table 3.9. Madagascar's annual agricultural production growth rates in 1986, 1995 and 2000

Crop	1986	1995	2000
Coffee, green	4.8	-2.9	0
Cotton lint	17	-19.5	-25.8
Cloves	-49.3	-7.1	4
Pepper	1.1	-16.7	-15
Rice, paddy	2.41	3.9	-17.1
Sugar cane	1.8	-3	0.9
Vanilla	-52.9	5	-11.8

Sources: World Bank, World Development Indicators and FAO database

The above declining rates reflect the destructive uses of agricultural resources in Madagascar throughout the past couple of decades.

Experts from the Ministry of Agriculture identify the following causes of stagnation in agricultural productivity:

1. Degraded irrigation infrastructure
2. Low market prices, resulting in a lack of motivation for farmers to increase cash crop production, hence the prevalence of subsistence agriculture in most of the country
3. Fragmentation and overexploitation of rice paddy holdings linked to the land tenure issue
4. Poor transport and communications infrastructure: roads and information on market prices for instance.

Trends in management and development

Historical Overview

Historically, agriculture in Madagascar has been dominated by two main themes. The east of the island and the highlands are characterized by typically Austronesian subsistence agriculture based on rice, cassava, sweet potatoes, pigs, and poultry. The west is characterized by extensive cattle raising, which owes its origins to Bantu Africa, and which is now widely practiced throughout the island. Both forms of land use have involved extensive

clearing of forest or woodland and cattle raising involves the annual burning of grassland for pasture. The underlying pattern has been overlain by additional uses, notably those introduced by Europeans before and during colonization, comprising the key cash crops — coffee, vanilla, spices, cashews, ylang ylang — the culture of fruits and vegetables and forestry — both timber felling and forestry plantations. Colonization also saw the introduction of a modern system of land tenure; however, this has been little used in relation to indigenously owned agricultural land where custom and tradition still prevail.

The erosion of soils and practice of *tavy* and grassland burning have long been recognized as key problems of land management. Madagascar's first king passed laws to limit deforestation and laws banning the practice of bush fires have been in place since the earliest colonial days. Clearing forest legally requires a permit — while individual, non-commercial, local usage for fuel and construction is permissible under rights of usage or "droits d'usage". Enforcement has always been a problem and the annual bush fires constitute virtually a cultural tradition, commonly increasing during times of political dissatisfaction. *Tavy*, on the other hand, is driven primarily by the need for land and is most intense in the east where population densities are highest. Research into *tavy* demonstrates that it brings real benefits to those practicing it (BEMA, 2001).

The application of ecological agricultural techniques is still at an early or experimental stage in Madagascar. The growing of leguminous plants in off-season rice paddy is becoming increasingly common as a means of enhancing nitrogen content of the soil, whereas direct sowing in which the soil is no longer ploughed is under trial and yielding very promising results (ANAE, CIRAD, TAFA, 2000). This method maintains the protective crust on the soil, which both limits soil erosion and moisture losses.

Dune stabilization with sisal

Current Legislation and Policy

Table 3.10 below is a non-exhaustive overview of legislation on management of agricultural resources. Of particular importance are the issues of land tenure, agriculture, livestock, agridiversity and reforestation.

For example, Objective N^{o} 3 of the National Strategy for the Sustainable Management of Biodiversity) under the theme "Reduction of pressures on biodiversity resources" proposes the promotion of livestock-rearing and of short-cycle livestock production as priority actions (Ministère de l'Environnement, 2001).

Table 3.10. Existing Agriculture-related legislation in Madagascar

Issue	Legislation	Purpose	Major statements
Land tenure	• *Law N° 60-004* • *Edict N° 62-042* • *Edict N° 73-073* • *Edict N° 74-022* • Decree *N°* 97-949 • Decree *N°* 98-610	• Establishing the general principles for land tenure management. • Establishes the creation of a rural development exploitation area (Aire de Mise en Valeur Rurale). • Elaborating the basic objectives for the development of rural areas. • Establishes land reforms and the general conditions for land management in rural areas, in the context of *Edict N° 73-073*. • Establishes the creation of regional commissions for land security reorganization called "cellule de pilotage foncier." • Instituting the launching of Relative Land Security (Sécurisation Foncière Relative).	• The state owns all non-registered lands. • Any infrastructure building or other improvement activity that would contribute to the economic and social development of the area is allowed. • The State offers assistance to increase agricultural productivity in rural areas by: providing land security to farmers, promoting technical innovation, facilitating the marketing of products, providing insurance and financial assistance in the form of credit or subsidies, promoting the creation of national food-processing firms. • Farms located within land management zones (zones d'aménagement foncier), including individual, collective or state farms, must be farmed by their owner/tenant. Sharecropping is forbidden. • The "cellule de pilotage foncier" is an entity within the Ministry for the management of lands and cities; the role of the cellule is to conceive, put into place and supervise/control projects related to the management of land. • Relative Land Security is the procedure consisting of delimiting the land area under which a local community has the management right over renewable natural resources, without that land being registered to that community's name.
Pastureland	• *Decree N° 61-079*	• Defines places where rules of *Order N° 60-127* must be complied to	• Burning licenses for the renewal of pastureland can be granted by authorities, provided climatic conditions allow the burning and that potentially burnt areas lay outside the national forest domain.
Livestock	• No official text yet	• National Strategy for Biodiversity conservation (objective N° 3 of strategic objective N° 1)	• Conserve and manage the genetic resources from livestock (create reproduction centers)
Agridiversity	• No official text yet	• National Strategy for Biodiversity conservation	• Continue the identification, the inventory of agridiversity resources Make local varieties and resources known to improve food security
Slashing and Burning	• *Order N° 60-127*	• Distinguishes between three types of fires • Regulates the circumstances under	'Cultivation' and 'cleaning' fires for future agricultural cultivation; can be lit without formal approval provided they lie outside the national forestry domain; 'Pastureland' fires for the regeneration of vegetation for livestock consumption; requires an

Issue	Legislation	Purpose	Major statements
		which and places where slashing and burning is authorized	authorization; 'wild' fires for no economic purpose; forbidden under ANY circumstance.
	• *Decree N^{o} 61-079*	• Reinforces Decree N^{o} 60-127	• The area to be slashed needs to be clearly delimited and the approval of the chief of the Water and Forests (MEF) provincial service required before the cutting license is granted; the area slope needs to be less than 50%, whether it be covered by vegetation or not. • No further cutting license will be given for areas that have been cut for less than four years to allow for relative soil and vegetation regeneration. • For potential slashing and burning of state lands, anti-erosion activities must be undertaken within one year. Neighboring forest areas owned by the national forest department must be clearly delimited.
	• *Decree N^{o} 82-313*	• Establishes pastureland specifications	• When new forest blocks are classified, the MEF's staff will make sure that some areas for agricultural use by the local community is spared at the edge of those new forest blocks. • The local rural development authority will assess the extent of the area to be burned for renewal of pasture land vegetation, taking the number of cattle and the quality and status of the vegetation
Reforestation	• Decree N^{o} 2000-383, June 19, 2000	▪ Defining reforestation rules and procedures	• Reforestation is to be carried out in specific reforestation areas, registered by the state for reforestation activities, or on other lands, provided the approval of the forestry commission (commission forestière) • Fiscal incentives to encourage reforestation will include state subsidies from forestry funds to contribute to land management protection and protection of reforested areas; non-payment of forestry license fees could be another fiscal incentives in exchange of reforestation activities by individuals, communities, etc. • There are five types of reforestation: 1. Industrial reforestation for the production of commercial and fuel wood; 2. Reforestation for ecological conservation and restoration of dunes, watersheds, soils, etc. 3. Reforestation for social purposes: education, recreation, etc. 4. Reforestation for experimentation with species 5. Reforestation for direct economic purposes: agriculture, pasture • A 15-year reforestation plan is established in each district. The plan is carried out through yearly forests programs

The trends in management of agricultural resources vary with the resource, and are summarized in Table 3.11 below.

Table 3.11. Trends in the management of the main agricultural resources

Resource	Paddy	Other agricultural land	Rangelands and tanety	Agridiversity
Conventional management	Annual soil turning, planting, irrigation and harvesting Soil removal for brick making Insignificant soil conditioning Low fertilizer use Low machinery use	Planting with crops such as manioc, maize Planting of vegetables on smaller plots Limited soil conditioning for small plots	Annual burning, often uncontrolled Extensive pasture of cattle – land burned exceeds actual need for pasture by large factor	Peasant farmers conserve seed, and do some strain selection National silo stores seeds of all key crops but is in decline DEF manages tree plantations of native species Potentially valuable varieties of crops exist such as caffeine-free coffee
Trends	No change yet; production for subsistence prevails PADR proposes intensification, but without specifying the means	Tendency toward diversification, especially vegetables and fruits in highlands Increased use of leguminous plants, especially in agricultural project areas Increasing use of fertilizers for potato cultivation	No significant change yet Annual symbolic reforesting campaigns (*reboisement*) Soil improvement programs proposed (e.g., AFD) A few agro-ecological production pilot projects in the Lac Alaotra region (multiple crops)	Renewed interest in agridiversity (national biodiversity strategy) Growing interest in marketing some products – agri-business – under a specific labeling system Small quantities of fertilizers used in tree nurseries

Mini-projects and Watersheds approach

Between the years 1960 and 1983, the Watersheds approach was characterized by:

1. Interventions mainly reproduced existing modes of land use
2. Limited variety of interventions: tree planting, pasture, road rehabilitation
3. Erosion control measures exclusively mechanical

During the above period, concepts such as agroforestry and soil management and restoration were entirely absent. (ANAE, 1996).

At the start of Phase 1 of the NEAP, the National Environmental Action Agency (ANAE) was established with a mission to help conserve soils and reduce erosion.

The experiences of PE1 led to the view that soil conservation should be addressed at the watershed (*bassin versant*) level as the appropriate unit for soil conservation at a regional level.

The basis of the ANAE approach was that local populations should manage soil conservation activities. Following participatory rural appraisal at a given site, mini-projects were designed to meet local needs and promote soil conservation. The types of projects included forestry, agro-forestry, pasture, anti-erosion engineering, roads and tracks, water source management, well construction and action-research.

The new ANAE program focused on the management/restoration of watershed in the five ecoregions of Madagascar, depending on the needs of each respective region. The expected results under Environmental Plan 2 are:

1. The provision to the forestry sector of material
2. The full training of rural communities in organizational capacity
3. The establishment of a planning, coordinating, and monitoring system
4. The actual management and/or restoration of watersheds

Agroecological methods, diversification, and agribusiness

In an attempt to reduce anthropogenic pressures on forests and terrestrial biodiversity, the USAID-funded program, LDI, has promoted agricultural intensification and rural income diversification by promoting multiple uses of agridiversity resources in the Eastern forest corridor. LDI encourages farmers to replace annual crops — rice, manioc, and beans — which are usually produced in an unsustainable manner by use of *tavy*, with perennial tree crops that will prevent soil erosion, maintain or improve soil fertility, and produce sustained or increased yields without further land clearing or fallowing. The LDI Fianarantsoa project proposed the following agricultural diversification and agribusiness techniques:

- An intensive rice production (SRI) system and an improved rice production system (SRA), which consist of improving soil fertility through heavy composting, introducing new varieties of seeds, and using water control techniques — SRI allows farmers to make savings on factors of production's costs: labor, 'machinery', seeds and other forms of capital investments
- Fish production combined with rice production
- Restoration of denuded, eroded hillsides (*tanety*) with agroforestry (fruit tree production) and vetiver grass plantins. "The rehabilitation of tanety hillsides has commenced in 70 percent of all [169] villages with the extension of practice such as planting vetiver grasses on contours, planting biomass banks of leguminous shrubs for compost and as a source of pollen for bees, or tree planting for individual and community woodlots." (Freudenberger and Freudenberger, 2000)
- Sustainable harvesting of forests resources for essential oil production.

"In most villages, increases in rice production on small experimental plots have averaged about 20 percent and in some cases have risen to as much as 70 percent. […] Approximately 11 percent of all farmers [approximately 220 in 2000] now grow potatoes as an off-season crop. […] 51 percent of all farmers now build compost piles." Demand for such agricultural practices and agridiversity techniques is increasing, but funds are limited to expand them beyond the proximity of forests. (Freudenberger and Freudenberger, 2000).

The Swiss Development and Cooperation-funded BEMA projects have achieved very promising results in agroforestry, which was identified as an advantageous alternative to tavy.

Agroforestry is a technique whereby crops are grown under tree or shrub cover; the multiple ecological advantages are soil protection, increased soil fertility, habitat diversification, maintenance of watersheds, and carbon sequestration. Agroforestry offers a more diversified range of consumption and marketing products such as foods and wood.

In Beforona — Toamasina province, eastern part of Madagascar — farmers have been cultivating banana and coffee using *tanimboly*, an agroforestry technique. However, these *tanimboly* crops were not sufficiently diversified and rarely included perennial crops or a sufficient proportion of valuable tree species.

In an attempt to diversify production to include commercial crops, the BEMA project initiated experimental cultivation of ginger under the *tanimboly* conditions in October 2000, and the development of vegetation already seems promising (Nambena in BEMA, 2001). In light of these positive results, technicians recommended that crops such as cucumber, zucchini, beans, maize, carrots, and chilies be introduced and combined with more diversified tree species. *Crotalaria grahamiana, Tithonia diversifolia* and *Tephrosia candida*, for example, are species that would improve the physical and chemical quality of soils. *Cassia sianea*, on the other hand, produces strong and long-lasting wood, resistant to termites *(ibid.).*

Improved *tanimboly* techniques will mitigate negative aspects: loss of soil fertility, shortages of wood for consumption, lack of diversified sources of revenue for local people. However, for agroforestry initiatives to be fully optimal, innovations need to go beyond diversified cultivation, to include sustainable strategies for marketing products. Of high importance among these marketing strategies are the propagation of agroforestry knowledge, facilitating access to seeds after the end of agroforestry projects, such as those supported by BEMA or LDI, and facilitating access to market information through transport infrastructure development.

Rural development focus on poverty alleviation

The Malagasy government strategy for poverty alleviation is based upon the participation of the rural poor in the economy through agricultural and rural development, as manifested in the Poverty Reduction Strategy Document (DSRP), the Rural Development Action Plan (PADR), and the Rural Development Support Project (PSDR) (see section 3 of this paper).

3.2. Status and Trends

3.2.1 Forests and terrestrial biodiversity

There are five types of forests in Madagascar: dense humid forests (low, mid- and high elevation) in the north and east, littoral forests in the northeast, mangrove forests in the west, dense dry forests in the south, and spiny forests in the sub-humid and arid south and the southwest. As identified in the 2002 ETOA, approximately 90 percent of Madagascar's species are forest-dependent.

Tropical deforestation is a key contributor to species extinction. Madagascar's forests are among the most biologically rich and unique in the world. In spite of longstanding concern about forest loss, past estimates of forest cover and deforestation have varied widely (Dufils, J.-M. 2003). Analysis of aerial photographs (*c.* 1953) and Landsat images (*c.* 1973, *c.* 1990 and *c.* 2000) indicates that forest cover decreased by almost 40 percent from the 1950s to *c.* 2000, with a reduction in 'core forest,' defined as forest areas more than one kilometer from a non-forest edge, of almost 80 percent (Harper, et al., 2007)

Total forest cover is estimated to have been 10,668,800 ha in 1990 and 9,216,617 ha in 2005, representing a loss of 13.6 percent during that period. Annual forest loss during the 1990-2000 period was estimated to be 0.83 percent, and annual forest loss during the 2000-2005 period was estimated to be 0.53 percent (Table 3.1). Rates vary considerably by region, and there is evidence that deforestation rates have been lower since 2000 in certain humid forest corridors where very active community forest conservation initiatives are being implemented (M. Freudenberger, 2008).

Table 3.12 : Forest cover changes in Madagascar, 1990-2005 (MEEFT, et al., November 2007)

Forest Cover Metric	Hectares
Total surface area, Madagascar:	59,263,558
Forest cover in:	
1990	10,668,800 (18.0%)
2000	9,677,701 (16.3%)
2005	9,216,617 (15.6%)
Deforestation Rates	
Base area used for calculation, 1990 *	9,587,774
Deforested, 1990-2000	791,264
Annual deforestation rate, 1990-2000: 0.83%	
Base area used for calculation, 2000 *	8,845,587
Deforested, 2000-2005	236,560
Annual deforestation rate, 2000-2005: 0.53%	

* Because parts of the satellite images can be obscured by clouds, potential biases in estimates of rates can arise. Authors provide a best estimate of remaining forest cover in 2005 — "Forest Cover." They also provide an estimate of the rate of change in percentage per year that is unbiased because they did not include any areas that were obscured by clouds in either of the two dates in question. The area of forest that was not obscured by clouds is the "calculated" (forest) base, and was used as the base area in the estimation of the deforestation change rate.

Dry forest of Andohalela National Park

The following summaries of protected areas and species include those associated with Forests and Terrestrial Biodiversity, and with Freshwater Systems and Wetland Biodiversity and Marine and Coastal Ecosystem Biodiversity.

In 2003, at the World Parks Congress in Durban, South Africa, Madagascar's president announced a bold vision to increase the size of the country's protected area network from 1.7 million to 6.0 million hectares over five years. Known as the "Durban Vision," it is based on a national objective to conserve Madagascar's extraordinary biodiversity — 80 percent of the island's plant and animals are unique to Madagascar — while taking into account the economic imperatives that have caused environmental degradation. The vision provides a unique opportunity for Madagascar to manage the country's ecosystems to obtain the full benefits of the island's biodiversity and to move beyond unsustainable logging and clearing practices (USAID homepage, 2008).

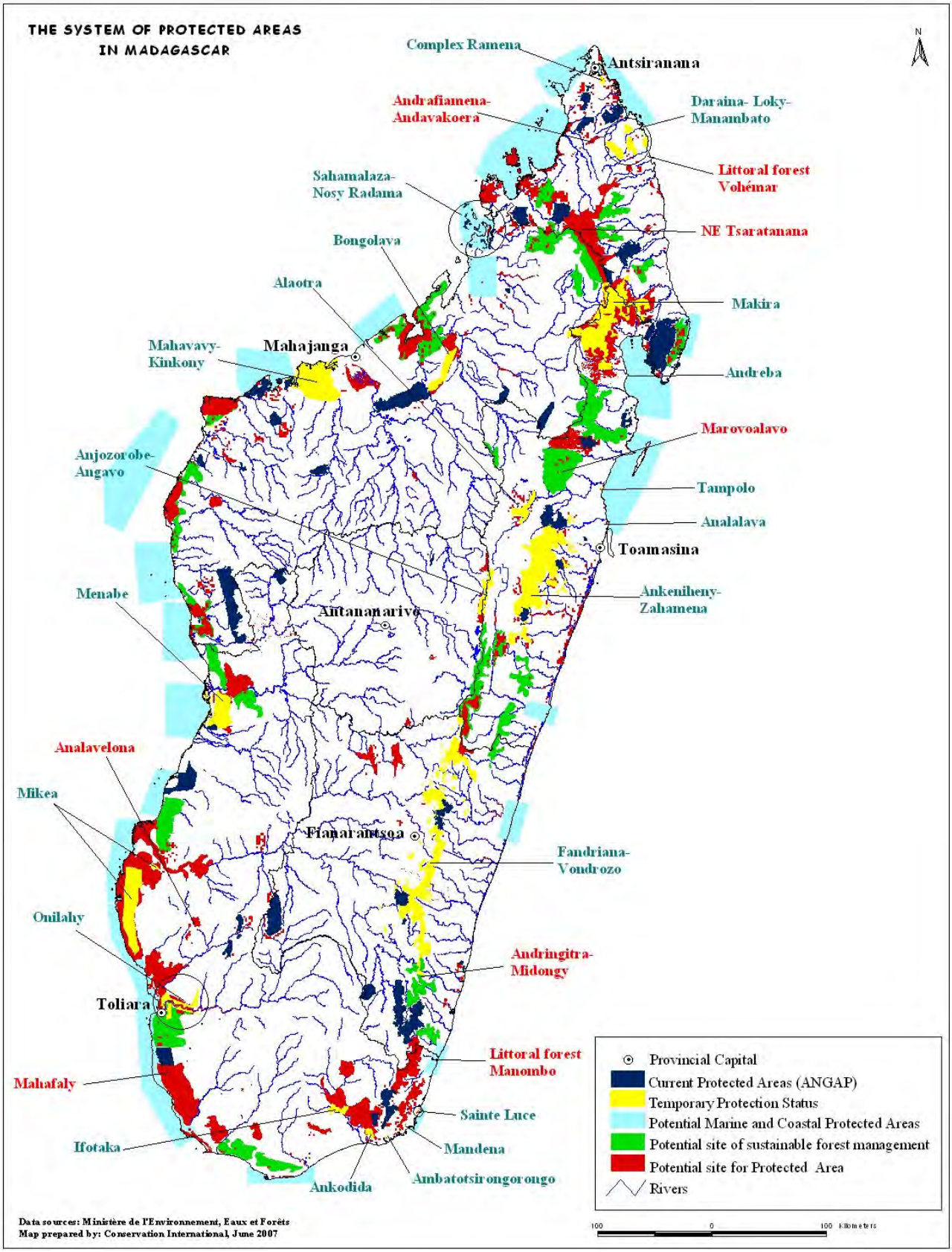
The total size of IUCN category protected areas in 2003 was 1,829,000 ha, making the protected areas 3.1 percent of Madagascar's total land area (Table 3.13). In addition, 16,000 ha of marine and littoral protected areas had been designated (WRI, 2003).

Table 3.13. The IUCN protected area categories and total size of designated protected areas in Madagascar, 2003

Cate-gory	IUCN Category Name	Hectares in Madagascar	IUCN Management Objective
Ia	Nature Reserve	1,106,000	Managed mainly for science
Ib	Wilderness Area		Managed mainly for wilderness protection
II	National Park		Managed mainly for ecosystem protection and recreation
III	Natural Monument	298,000	Managed mainly for conservation of specific natural features
IV	Habitat/Species Management Area		Managed mainly for conservation through management intervention
V	Protected Landscape/Seascape		Managed mainly for landscape/seascape conservation and recreation
VI	Managed Resource Protected Area (in Madagascar, includes some unclassified Protected Areas)	425,000	Managed mainly for the sustainable use of natural ecosystems

Under the "Durban Vision" and the MAP, Madagascar intends to establish 4.3 million ha of additional protected areas to achieve 6 million ha by 2012, and designate another 165,915 ha as Ramsar Convention wetlands — including 25,415 ha of lakes, 23,500 ha of marine and coastal wetlands, and 117,000 ha of rivers. It also has set a goal of increasing its IUCN protected area management index efficiency from 45 percent to 70 percent (MinEnvEF, 2006). Between 2003 and 2006, Madagascar gave provisional protected area status to 20 additional sites, totaling approximately 2 million ha. In 2007, 730,000 more ha of areas were given a temporary status as protected areas, and in 2008, 300,000 more ha are expected to obtain the same status. This will result in a total of 4.4 million ha (Source: Commission SAPM). Final protected area status for several sites is expected later in 2008. Current protected areas, provisional protected areas, potential protected areas are given in Figure 3.3.

Figure 3.3 Current, provisional and potential protected areas in Madagascar



Madagascar's flora and fauna biodiversity is recognized as unparalleled. With its diverse land, freshwater, and marine ecosystems, large numbers of species, extraordinarily high percentage of its species are endemic to Madagascar, and high number of species that have been identified by the IUCN as threatened, and numerous species whose trade is controlled under CITES Appendices I and II, protection and use of its biodiversity is of very high local, national and global concern.

Conservation International has identified Madagascar as one of 34 biodiversity "hotspots" in the world for conservation focus due to exceptional levels of plant endemism and significant levels of habitat loss. A "hotspot" must meet two strict criteria: it must contain at least 1,500 species of vascular plants (a figure that represents more than 0.5 percent of the world's total) as endemic species, and it has to have lost at least 70 percent of its original habitat (Conservation International homepage, 2008). Madagascar has lost more than 90 percent of its natural vegetation, and has extremely high levels of endemism. An estimated 80-86 percent if its estimated 12,000 plant species are endemic (MinEnvEF, 2006). The dry forests of southern and southwestern Madagascar have the highest level of plant endemism on the island, with 48 percent of the genera and 95 percent of the species found nowhere else on the planet.

With its 49 species of lemurs (60 taxa), it has more critically endangered and endangered primates than anywhere else. Some 35 percent of all its mammals are threatened, and Madagascar is the highest ranked country in the world in this category (IUCN, 2007). The dry forests of southern and southwestern Madagascar have the highest level of plant endemism on the island, with 48 percent of the genera and 95 percent of the species found nowhere else on the planet.

Recently, five of the nine assessed Madagascar turtle species were downgraded from endangered to critically endangered status, with one — the ploughshare tortoise — numbering only a few hundred individuals. The other four are the radiated tortoise, flat-tailed tortoise, spider tortoise, and Madagascar big-headed turtle, all of which are endemic.

As of 2006, 211 plant species and 1,047 animal species were identified as invasive species, which are having significant impacts on the environment and protected areas, and threatening some native species with extinction (MinEnvEF, 2006).

Table 3.14. Status of species in Madagascar

Species Group	Number of Species Known in Madagascar (WRI, 2003)	Number of Species on the 2007 IUCN Red List (IUCN, 2007)	
		Threatened *	Endemic
Higher plants	9,505	280	
Mammals	141	47	43
Breeding birds	171	35	27
Reptiles	381	20	4 #
Amphibians	217	55	55
Fishes	390	73	-
Molluscs	-	24	-
Other invertebrates	-	8	-
Total		542	

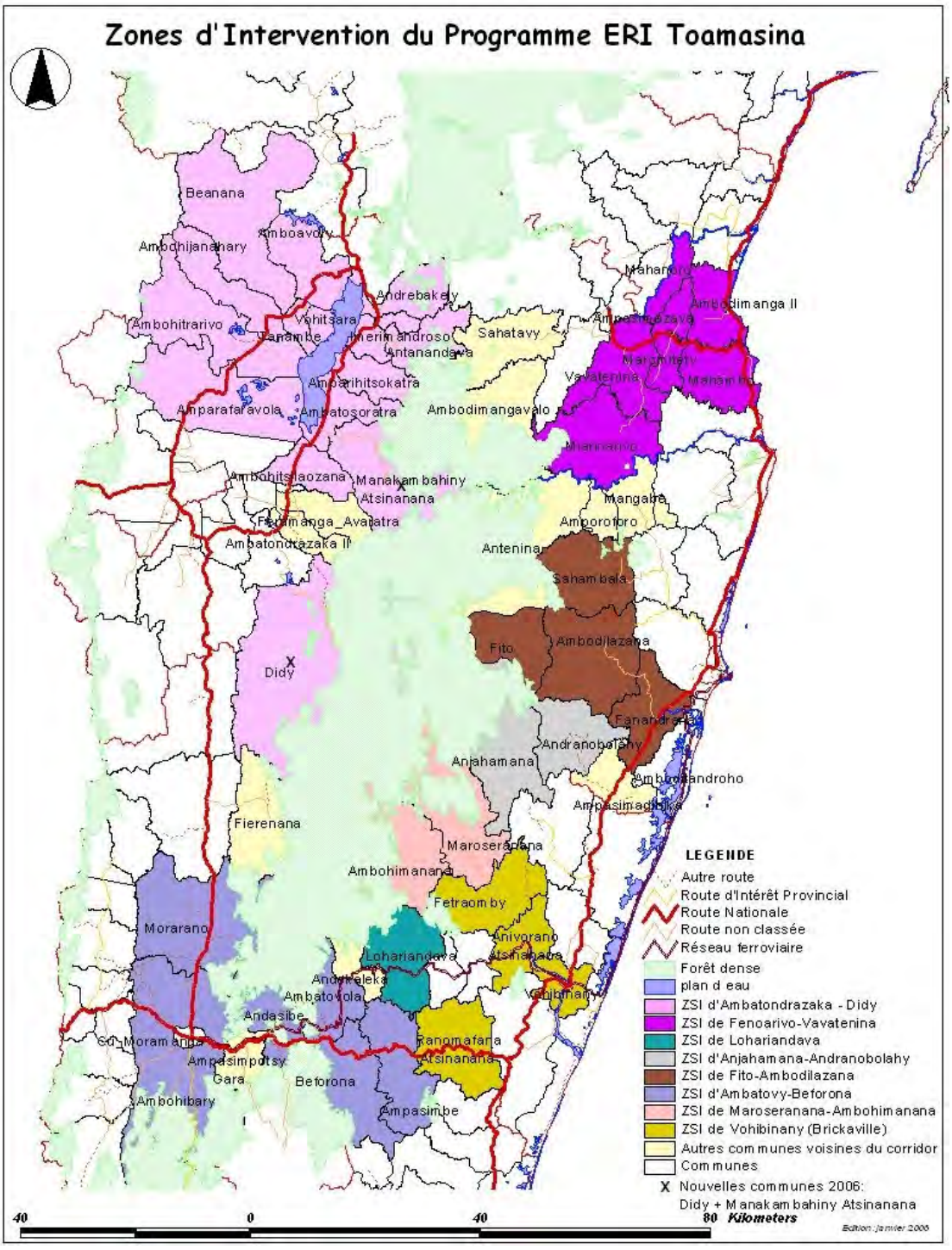
* IUCN Threatened designation includes the critically endangered, endangered, and vulnerable status categories
# Turtles only

Currently, there are 30 plant species and 85 animal species from Madagascar that are on CITES Appendix I — export of all species is forbidden with few and strict exceptions). There are 353 plant species and 610 animal species from Madagascar on CITES Appendix II — export of all species is strictly controlled.

Some 164 “key biodiversity areas” (KBAs) in Madagascar have been defined by Conservation International. Trends show that the total percentage of the KBAs under some form of legal protection has increased from 40 percent in 1996 to 60 percent in 1998-2004 period, and increased to 70 percent in 2006 (Conservation International, 2006).

To encourage rural development, stakeholder benefits and responsibilities, and contribute to sustainable natural resource management, local communities are engaged more and more in land and resource management. Some 500 natural resource management transfers to local communities have been made, including 178,000 ha of forests, 54,835 ha of mangroves and 54,850 ha of fishing waters (MinEnvEF, 2006). Figure 3.4 shows the Toamasina example.

Figure 3.4. ERI program intervention zones in Toamasina



3.2.2 Freshwater systems and wetland biodiversity

Of the 143 native freshwater fishes, recognized in Madagascar, belonging to 21 families and 54 genera, more than 65 percent are endemic to Madagascar (Sparks and Stiassny 2003). Some 73 percent are estimated to be threatened with extinction — 22 percent critically endangered, 34 percent endangered, and 17 percent vulnerable under IUCN criteria. The combination of deforestation, overfishing, and exotic species introduction, has affected most

of the island's freshwater habitats, making freshwater fishes Madagascar's most threatened vertebrate taxa (Benstead, et al., 2003).

Deforestation has adversely affected stream and river ecosystems and fish, including increased sediment delivery, higher insolation and water temperatures, higher nutrient loads, and changes in the availability of basic food resources. Of all these changes, increased sedimentation caused by accelerated erosion has had the most devastating effect on rivers, especially those draining the highly erodible lateritic soils of the central highlands (Benstead, et al., 2003).

3.2.3 Marine/coastal ecosystem biodiversity

Of the 10,627 marine species known from the coastal waters of the Indian Ocean, the Great Toliara Reef — the largest barrier reef in southwest Indian Ocean and the third longest barrier reef in the world — harbors more than 5,500 marine species (MinEnvEF, 2006).

A Decree (2007-957) was established in 2007 to manage the marine resources, particularly shrimps and prawns. The Ministry intended to reduce shrimp capture in view of a more sustainable use of the resource. This decree applies to the traditional fishery sector. At that level, shrimp capture is enforced by the Fisheries Control Center. In terms of pelagic fishes, the industrial fleet from the European Community alone exports about 6,000 tonnes per year of tuna and other species from waters off Madagascar's coast.

The marine environment in Madagascar suffers from problems often linked to each other. Unlike terrestrial biodiversity, basic scientific information on marine biodiversity is still lacking. And, marine programs do not attract many conservation initiatives, probably because of their complexity and the high cost of running such a program. Fuel consumption, e.g., of a motorized boat is twice as high as a four-wheel drive vehicle. Fuel in Madagascar cost US$6.15 per gallon in early 2008. Conflict of interest between stakeholders in the same geographic area often occurs; this is the case in the coastal zone with the presence of traditional fishery, industrial fishery, tourism, and other sectors. Laws and regulations for environmental protection do not exist; however, on a positive note, the process to create such a law was started in February 2008.

3.2.4 Agricultural resources

Madagascar continues to have significant potential for more intensive, extensive and diversified sustainable agricultural production. It possesses extensive arable lands, only a small fraction of which is currently exploited. Its assets in terms of diversified ecological zones would be favorable for agricultural diversification.

Agriculture production continues to decline. The per capita average agricultural production growth rate in Madagascar from 1990 to 2004 was a negative two percent per year (FAO, 2007).

3.2.5 Economic value and importance

The global value of Madagascar's forests and biodiversity remains very high. A recent study identified a mid-range estimate of US$330 million as the global net present value of conserving biodiversity in the forested corridor that joins the National Parks of Ranomafana

and Andringitra and the Special Reserve of Pic d'Ivohibe in eastern Madagascar (Hockley and Razafindralambo, 2006). It is also estimated that the mid-range net present value of costs to forest frontier communities is more than US$1,400 (range: US$196-US$2,610) per average household.

3.3 Principal Threats to Forests and Biodiversity

The principal threats to forests and terrestrial biodiversity, freshwater system and wetland biodiversity, and marine and coastal ecosystem biodiversity identified in the 2002 ETOA still remain. They are supplemented and updated with the following from this assessment:

3.3.1 Slash and burn agriculture (*tavy*)

This traditional practice remains widely used despite educational efforts by NGOs, donors, and the Malagasy government. As shown in fire maps, tavy is a primary cause of deforestation around protected areas, although its prevalence within protected areas has diminished.

3.3.2 Population pressures

Continued population growth rates exacerbate pressures on all types of ecosystems. High density rates and high population growth constitute a serious threat to the remaining humid, mangrove, dry and spiny forests. More mouths to feed and fixed amounts of land translate to higher levels of resource exploitation. As their intensity and amounts increase, traditional practices are often not environmentally friendly or sustainable. Migration from poorer or afflicted communities far from existing and proposed protected areas to lands in and around protected areas illustrate the tendency for Malagasies to turn to the forests and ocean as resources in hard times.

Illegal felling beside the road in the Ranobe dry forest

3.3.3 Energy needs, logging, and mangrove deforestation

In Madagascar, rural people's livelihoods depend heavily on forest resources. The 2002 ETOA estimated that, in 1998, 96 percent of collected forest products in Madagascar consisted of wood for household consumption, especially in the form of charcoal. In recent years, there has been significant loss of mangroves and spiny forests, as they have been cut to provide fuel wood and charcoal for surrounding communities. Mangroves are essential components of functional and stable coastal and marine ecosystems, and are valuable forests in themselves.

3.3.4 Exploitation of species for wildlife trade, over-fishing, and other illegal/illicit exploitation of natural resources

Charcoal transport from Anakao

Illegal exploitation of natural resources continues to be an overarching concern, as it could reduce the impact of efforts to conserve Madagascar's biodiversity. As unregulated and illegal exploitation of wildlife, forest products, precious minerals, and fisheries has expanded, illegal exploitation has come increasingly under attack. Corruption and inadequate government management of natural resources, and enforcement of the Convention on the International Trade of Endangered Species (CITES) and other legal controls that affect the environment are major constraints in the attainment of expected results at the field level.

Madagascar ratified CITES in 1975. Export quotas are tools used to monitor and regulate trade in species listed in the appendices to CITES. Under Appendix I trade is forbidden except for research purposes; Madagascar has listed 85 animal species, including all lemurs, dugong, angonoka and radiated tortoises, sea turtles, whales, the boa, *Acanthropus sp*. snakes, peregrine falcon, Soumagne's owl, and 30 species of plants, e.g., pachypodium and aloes.

Under Appendix II trade is controlled according to quotas and monitoring; Madagascar has listed 608 animal species, including the two fossa species and Malagasy mongoose, all raptors and owls, flamingos, Bernier's teal, parrots, all other terrestrial tortoises, the freshwater turtle *Erymnochelys madagascariensis*, all day geckos, all chameleons, fish species such as the coelacanth, the whale shark and the great white shark, the Nile crocodile, and the golden tree frog *Mantella aurantiaca*.

Under Appendix II, Madagascar has listed 353 plant species, including all aloes, all cacti, tree ferns, cycads, Didiereacea, Dicksonaceae, *Ceropegia spp*., *Euphorbia spp*., all orchids, *Chrysalidocarpus spp*., and the three-cornered palm (*Neodypsis decaryi*). The lists are far from complete, although officially Madagascar considers itself bound to enforce CITES lists irrespective of whether they have been declared under national law.

In 2005 Law 2005-018 established procedures for international trade to conform with CITES, strengthen protection of non-CITES wildlife species, establish definitions of infringements of the rules of international trade, and sets deterrent penalties for violators. No specimen of any CITES-listed plant species, including seeds, spores, pollen, *in vitro* cultures and cut flowers,

may be exported without an export permit.

To adhere to international CITES standards and support management decisions, the Malagasy government has identified a need to develop and clarify national policies on these CITES topics:

- Objectives for CITES management in Madagascar (see: MinEnvEF, 2006)
- Decentralization of enforcement
- Sharing commercial receipts with the local communities where species or products are harvested
- Management policies for areas where imported species are held
- Developing/establishing criteria for allocation quotas and permits

3.3.5. Increases in mining operations

Higher world market prices and economic stimulation policies has spurred a recent increase in large and small mining operations; large operations can have great impacts on ecological systems, especially forests. Mining in the north (Ankarana), which started in 1996, resulted in a 10 percent loss of forest (the Special Forest Reserve of Ankarana is 18,000 ha). Mining for nickel and cobalt in Ambatovy has resulted in very significant losses of primary forest. In addition to significant on-site alteration of vegetation caused by mining, associated large-scale erosion and increased population pressures can cause environmental disasters. Small-scale mining can irreparably damage forested areas, increasing fragmentation. Inter-ministry miscommunications have caused land use conflicts and last minute land grabs. Although the percentage of total forest loss nationwide from mining is relatively small, impacts may be more permanent, given the associated earthworks.

Exploratory mine permit locations in Madagascar are given in Figure 3.5., page 71. Exploratory oil and gas permit locations in marine and coastal ecosystems are given in Figure 3.6., page 72.

Madagascar does have legislation, under the MECIE Decree, that requires a potential mining company to prepare an environmental impact assessment before a mining permit is awarded.

3.3.6 Sedimentation from soil erosion

Slash and burn farming, logging, and mining are significant threats to soils, vegetation and watershed conditions. Deforestation and poor agricultural practices have caused increased sedimentation of rivers, lakes, wetlands and coastlines. This directly threatens the biodiversity and ecological stability of these areas. Surveys have shown that before the 1980s, fallow periods averaged around eight years; one decade later, fallow periods have been reduced to two to five years. Such a short period barely allows the vegetation to reach a shrubby stage before land is returned to exploitation. Consequently, the agricultural land under exploitation has a reduced chance of recovering its vital nutrients. Over time, degradation in soil texture and soil erosion occurs. This phenomenon is visible in the southeast of Fianarantsoa province, between the coastal plain and the mid-altitude tropical forest.

Logging and slash and burn also contribute to the degradation of watersheds. This is especially grave, given that water quantity and quality is a vital — and, in some areas of the country, very rare — agricultural resource.

3.3.7 Climate change

Global warming affects all ecosystems in potentially disastrous proportions. Forest corridors will be further invaded by agriculture as the ability to cultivate at higher elevations becomes possible. Coral reefs become bleached and lifeless. Rising sea temperatures and levels drastically affect coastal and marine systems. The gradual drying of areas in the southwest and west increase food insecurity, and increase pressures on forest, soil and water resources. Increasing cyclone activity poses increasing threats to infrastructure and agriculture.

3.3.8 Inefficient and traditional agriculture

These practices lead to increased soil infertility, poor harvests, and food insecurity. Rice, as a primary staple of Madagascar and requiring high amounts of water, is dependent on sound upstream watershed protection and management. Use of traditional agricultural practices will not meet needs caused by population growth.

3.3.9 Lack of institutional capacity

The lack of institutional capacity refers not only to having inadequate management resources, but also to training and institutional support of ministry and agency personnel. Improving institutional capacity is acknowledged by donors, NGOs, government ministries, and local communities as a need to be addressed. Institutional instability and the large expansion of responsibilities of the MEEFT by way of the Durban Vision and mining activities further highlight the necessity for capacity training and development if the Ministry is to be effective in administering new protected areas and performing other responsibilities, particularly at the regional level.

Figure 3.5 Current protected areas, provisional protected areas, potential protected areas, and exploratory mine permit locations in Madagascar

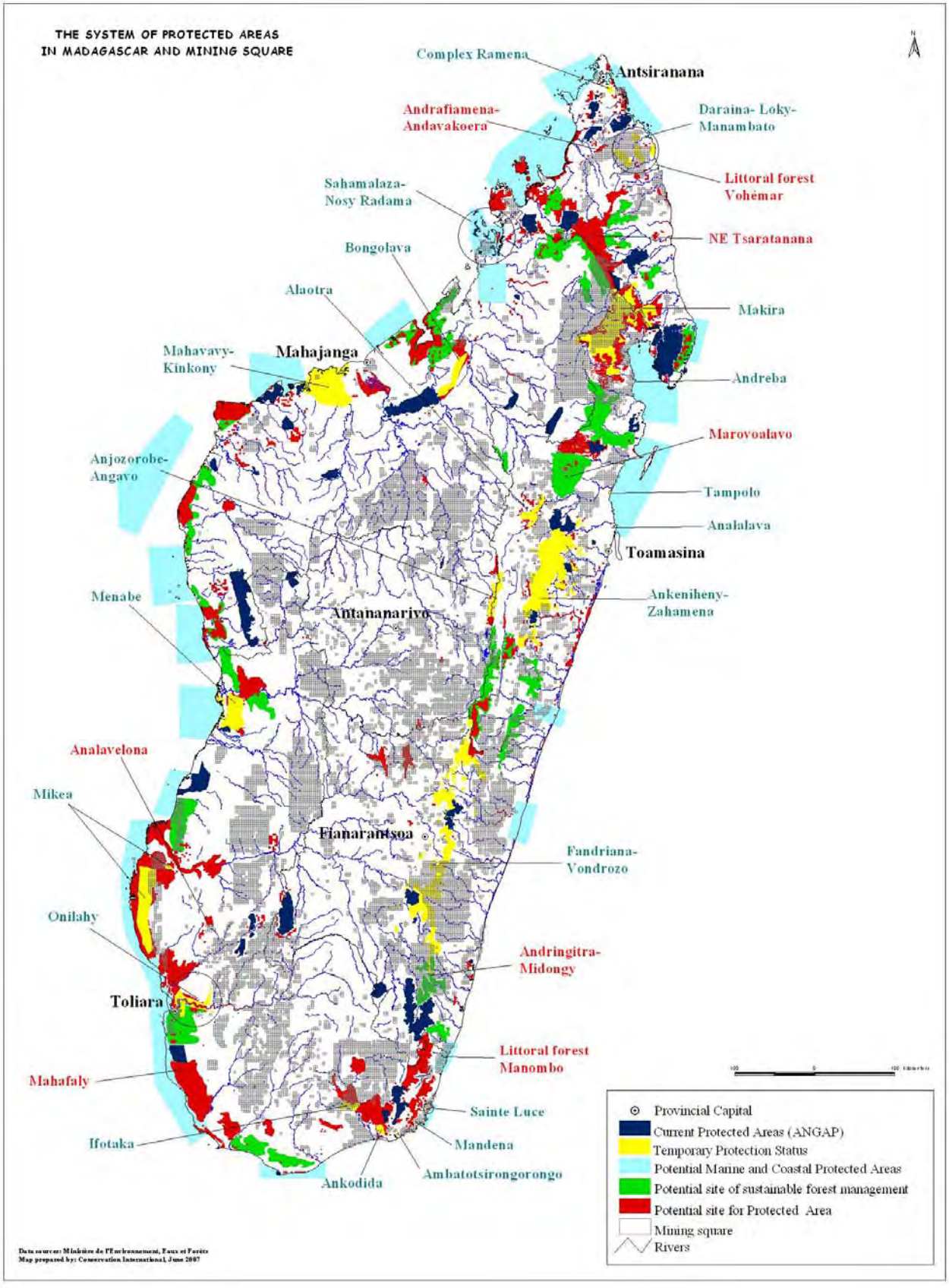
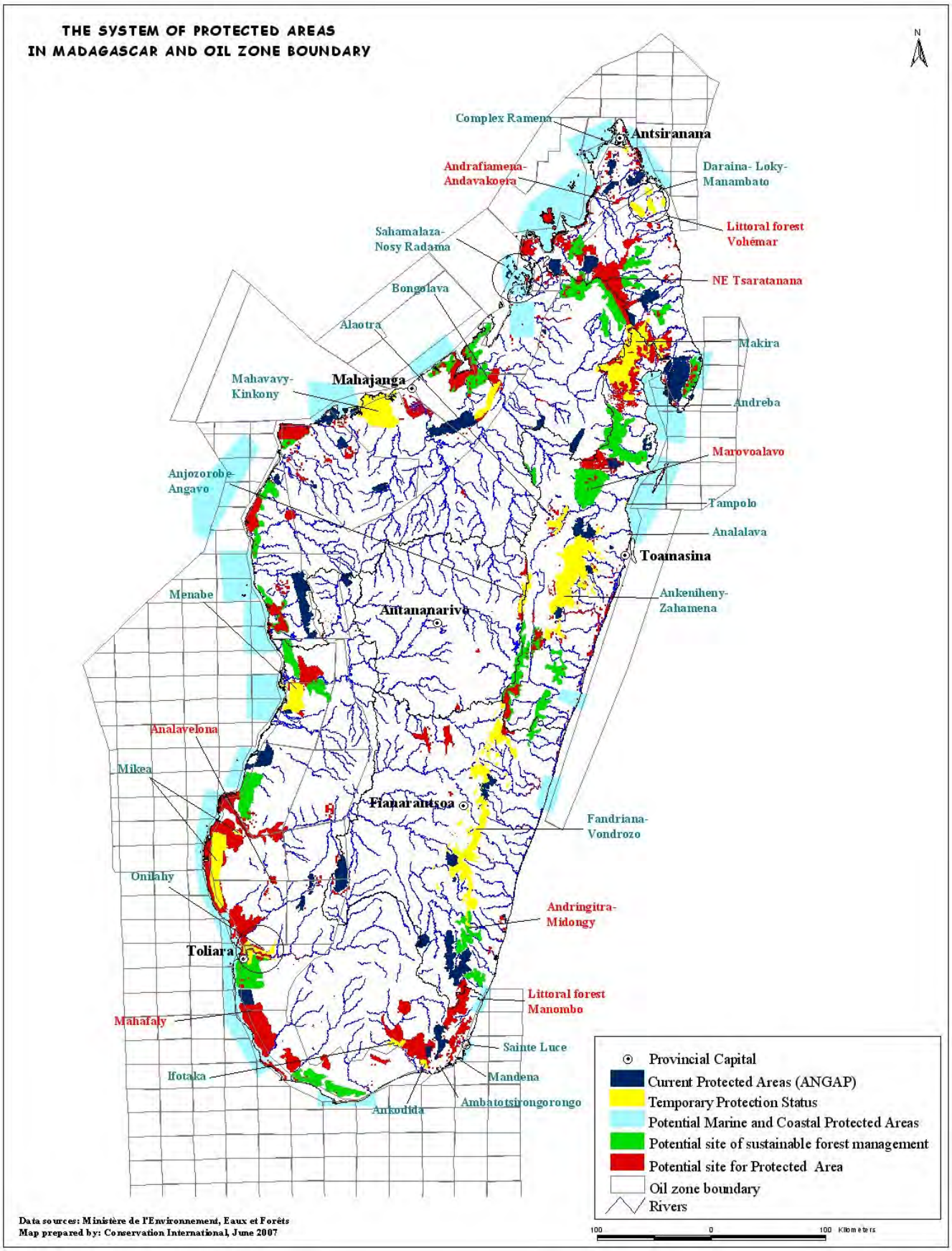


Figure 3.6 Current protected areas, provisional protected areas, potential protected areas, and oil zone boundaries



3.3.10. Weak market infrastructure and linkages

Promotion of alternative livelihoods key to natural resource conservation as forests are a resource and an income generator for communities. Market infrastructure linkages directly support the development of alternative livelihoods, such as ecotourism, agricultural production increases and diversification, and trade. Weak infrastructure and linkages not only discourage these activities, but impede them.

3.3.11. Land tenure

The lack of a strong land tenure system, and ill-defined property rights in general, discourage agricultural intensification practices. They hamper protection and regeneration of natural resources. It encourages traditional agricultural practices such as *tavy*, which results in forest loss, soil erosion, and loss of soil fertility. The lack of land for future rice cultivation is a major threat to agricultural production.

3.4 Indicated Responses

The following are key indicated responses to the threats to forest loss and biodiversity loss in Madagascar, as identified by this 2008 ETOA update. A complete list of threats and indicated responses can be found in Section 5 in Table 5.1.

3.4.1. Forests and terrestrial biodiversity

The indicated responses to the identified threats identified in the 2002 ETOA continue to be needed. Since the major threat to forests is land clearing for agricultural activities, urgent required measures could be:

- Community-based management, or co-management between the community and another party, of natural resources should be sustained, and technically supported
- Promotion of agricultural intensification *away from forest blocks*
- Promotion of agro-ecological techniques in agricultural production to reduce forest loss
- The promotion of industrial development in cities to encourage migration of labor away from forests
- Use the newly created Biodiversity Fund to manage the newly designated protected areas
- Implementation of trade controls on hardwoods, including obligatory certification of sustainable harvesting
- Intensive reforestation programs supported by environmental education and awareness raising activities
- Promotion of the sustainable use of forest products (e.g., essential) to the benefit of local communities
- Use of alternative source of energy, such as wind and solar; use of improved stove system (foyers améliorés)

3.4.2 Freshwater systems and wetland biodiversity

The responses to threats identified in the 2002 ETOA are still needed:

- Reduce forest loss and soil erosion.

Degraded mangroves with fresh water seeps near Toliara

- Place lakes and wetlands under “wise use” community-based management.
- Take urgent parallel measures to prevent extinction of endangered fishes.

3.4.3 Marine/coastal ecosystem biodiversity

The responses to threats identified in the 2002 ETOA are still needed:

- Improved governance of the fisheries sector: the problems are in many respects analogous to those of the forest sector
- Introduction of soil conservation practices, especially on upland areas draining into the lower reaches of the larger rivers
- Establish community-based resource management and integrated coastal zone management in densely populated coastal areas, applying an integrated coastal/river basin approach

3.4.4 Agricultural resources

The principal responses to threats identified in the 2002 ETOA are still needed:

- Reforestation and soil conservation/restoration programs
- Forest conservation programs, for example through conservation contracts
- Improved rural education
- Improvements in land tenure and reinforcement of land tenure legislation
- Promotion of credit facilities that are more advantageous than informal sources of credit
- Improved agricultural production: agro-ecological techniques, multi-cropping
- Promote rice cultivation using agro-ecological techniques
- Improved communication and transport infrastructure to reduce transaction costs and allow better integration into markets
- Encourage and promote private agricultural enterprises and agribusiness to work with local communities
- Reinforce a bio-certification system in agricultural and agribusiness sectors

4.0 ANALYSIS OF PAST AND CURRENT INITIATIVES

This section discusses ongoing and past environmental initiatives that have a direct impact on the protection, conservation, and use of Madagascar's biological — terrestrial and marine — resources. Although the primary focus is on USAID's program and project investments in the sector, other significant national, bi-lateral/multi-lateral, private sector, and nongovernment-led actions are also scrutinized here.

4.1 2002 ETOA Background

4.1.1 National Environmental Action Plan (NEAP) and related activities

Introduction

Madagascar is unusual in its role as the object of a coordinated, multi-donor, environmental program referred to as the national environmental action plan (NEAP). NEAP is a 15-year program in three five-year phases known as Environmental Program (EP) 1 (1991-1996), EP2 (1997-2002) and EP3 planned for 2003-2008.

The NEAP is by far the most significant initiative with respect to the environment in Madagascar in recent years, representing an investment of more than US$450 million in the course of 15 years, employing directly or indirectly thousands of people, affecting the lives of several hundred thousand more, and directly intervening in more than 25 percent of Madagascar's 590,000 km^2 land surface. The NEAP has had a substantial leverage effect, encouraging many related activities not formally integrated into the NEAP structure but which pursue similar objectives and which probably represent an additional 50 percent on the original investment.

NEAP has been a colossal learning experience for all concerned. While the goals and guiding principles have remained unchanged since 1991, increased knowledge and experience have led to significant shifts in perception about how NEAP's goals might best be achieved and the extent to which they are achievable.

Genesis of NEAP

Genesis of NEAP began in the early 1980s when the resurgence in biological research, which accompanied renewal of relations with western powers reaffirmed Madagascar as one of the world's top conservation priorities, on the basis of its extraordinary biodiversity and the very high level of threat to that biodiversity. With the assistance of donors, research institutions and NGOs, in 1984 the government adopted a strategy for conservation and for sustainable development,

During the 1980s, much of the development community became convinced of the links between biodiversity loss, poverty, and economic development, and the concept arose for a coordinated, integrated program designed to tackle environmental problems within the context of sustainable development. There was thus born the Charter for Environment of 1990 (Law 90-033), which had multiple purposes:

1. To lay down fundamental environmental principles, e.g., duty of all to protect the environment)

2. To present a description of the country's environmental problems and the links between environment and human development
3. To define the national policy on environment
4. To establish the NEAP
5. To define the broad objectives of NEAP and its three five-year phases while retaining flexibility on the precise objectives and means of achieving them
6. To define the institutional framework for the environment

The Charter is not purely a conservation instrument — it stipulates that "environmental action is not solely restricted to the protection and the conservation of natural resources, of rare species or sites. It goes hand in hand with actions toward sustainable socio-economic development."

Objectives of the NEAP

NEAP's goal is to "*end the spiral of degradation while reconciling the population with its environment.*"

To achieve that goal the NEAP emphasizes the need to *change the behavior* of people in relation of the environment, in particular on eradicating the practice of tavy as the most serious threat to biodiversity. The Charter advocates the abandonment of the "project approach" in favor of a "program approach" and an end to a "culture of dependence." Finally, the Charter advocates concrete action as the only way to "win the war for conservation and development."

Strategy of NEAP

The strategy of NEAP is essentially the same as the national strategy of 1984 with some adjustments, and is based upon three tenets:

- A recognition of humans' place in the biosphere
- The need to advance knowledge of the environment and of humans' impacts thereon
- The need to change human behavior in relation to the environment

The strategy is implemented through the mobilization and participation of the main actors of social, economic and political life, with a particular emphasis on communities taking responsibility for the protection and management of their own surroundings. The strategy calls in particular for:

- An integrated approach
- A long-term vision
- Adopting a beneficiary's perspective
- Communication and dialogue in place of injunctions
- Use of methods appropriate to the myriad contexts

In addition, the strategy sets out sub-strategies for specific sectors: education, watershed management, land tenure, biodiversity protection, ecotourism, improving rural and urban environments, developing tools for management, environmental protection and monitoring and the institutional framework. It then proceeds to define regional strategies for Madagascar's principal regions (Central highlands, East, Midwest, West, North, and South).

Finally, NEAP's operational sub-strategy is based on:

- *Conservation,* i.e., building on existing structures rather than new ones
- *Rehabilitation,* restoration of structures that formerly performed the functions required
- *Innovation,* in cases where the structures with the required functions do not exist

Implementation of NEAP

The three phases of NEAP were conceived as set out in Table 4.1 below:

Table 4.1. Original objectives of EP1, 2 and 3 – Charter for the Environment

NEAP Phase	Main purpose, objectives and orientations
EP1	NEAP start-up phase, including: • Achieve coordination of activities • Dynamize institutions • Set up institutional frameworks • Set up program financing • Establish program procedures, norms, and performance criteria • Put in place the environmental legal framework, notably for EIA • Put in place environmental monitoring mechanisms • Implement program activities • Conduct pilot operations and action research with a view to EP2
EP2	Action orientated phase – intensification of actions initiated in EP1: • Concrete action in biodiversity conservation, soil conservation, cartography, and cadastre • Integration of NEAP into the national development plan • Reorientation, reflection, and consolidation of actions • Continuing program coordination
EP3	Mainstreaming phase – environmental "reflex" to become automatic: • Complete integration of NEAP into the national development plan • Populations, collectives, ministries, and NGOs actively implementing techniques of environmental management • State structures systematically applying the environmental concept in sector policies and programs • National plans and programs make environment and conservation a driver for sustainable development

Each phase has been the subject of mid-term or end-of-phase reviews resulting in modification and orientation of objectives and approaches (given below in the description of each phase of NEAP).

Environmental Program 1 (EP1 1991-1996)

The two principal objectives of the Environmental Plan 1 were to:

- Establish the foundations for environmental management through institution building, studies and human resources development.

- Protect biodiversity within national parks, reserves, and gazetted forests, along with improving the livelihoods of surrounding communities.

Environmental Plan 1 focused on mitigating deforestation and erosion of areas where the impact on these would be the most devastating economically. Estimated costs of Environmental Plan 1 were US$150 million with principal funding coming from the World Bank, USAID, and other bilateral sources — Holland, Switzerland, UK — and NGOs — especially WWF.

Environmental Plan 1 consisted of seven components:

1. Integrated conservation and development projects (ICDPs) for threatened ecosystems
2. Community-based soil conservation, agroforestry, reforesting, and watershed management
3. Promotion of land management tools and the set up of a GIS and mapping system
4. Improvement of land security through cadastral operations
5. Promotion of environmental communication, training, education and awareness-raising
6. Environmental research on terrestrial, coastal and marine ecosystems
7. Supporting activities such as institutional capacity building, elaboration of environmental impact assessment procedures, reinforcement of the environmental database, environmental research, monitoring and evaluation, and sectoral policy studies.

Significant related activities to Environmental Plan 1

Among the significant related activities during Environmental Plan 1 were:

- Madagascar wetlands conservation project — Peregrine Fund
- Swiss Co-operation forest conservation program at Kirindy, Morondava — CFPF
- Biodiversity research and institutional support by international organizations including botanic gardens (MBG, RBG Kew), universities (Michigan, Princeton), institutes (ORSTOM), museums — Chicago
- Small NGO conservation projects — Jersey Wildlife Conservation Trust

Results and lessons learned from Environmental Plan 1 and related activities

As the program was coming to an end in 1996, donors, in particular USAID, helped link the learning objectives fundamental to the Environmental Plan 1 program with efforts to design Environmental Plan 2. The most important outcomes of the Environmental Plan 1 were:

- The program was too narrowly focused on protected areas; it was recognized that efforts needed to be expanded beyond protected areas to add corridors, classified forests, littoral forests, *marine/coastal ecosystems*, and other related landscapes
- ICDPs were complex to manage and too costly when compared to the limited population reached, to be considered sustainable
- Modern sectoral environmental policies elaborated by the national office for the environment (ONE) but were not being implemented
- A foundation — Tany Meva — for the financing of mini-projects was established
- Having been successful during Environmental Plan 1, community-based activities should be continued and expanded during Environmental Plan 2
- Sources of pressure and threats to Malagasy biodiversity need to be addressed at both regional and national levels.

Environmental Program 2 (1997-2002)

Environmental Plan 2 was conceived as the piloting phase within the national environmental action plan.

The estimated cost of Environmental Plan 2 has been US$155 million, with principal funding from the World Bank, UNDP, EU, United States, France, Germany, IFAD, Japan, Switzerland, Holland and Norway.

Experience from Environmental Plan 1 generated these orientations for EP2:

- Expand conservation and development beyond national parks and reserves into a *regionalized* landscape approach focused on identifying and protecting key biodiversity conservation zones, e.g., forest corridors
- Identify key areas for agricultural intensification and economic growth to decrease the pressure on natural resources by addressing the growing agrarian crisis and using the private sector as a catalyst
- Include a new coastal zone management and marine resources component
- Integrate environmental activities in the decentralization process and with other sectoral activities in areas of regional rural development and economic growth.

Environmental Plan 2 comprised the following components:

Direct action components:

- Conservation of protected areas and ecotourism (CAPE)
- Conservation management of soils and watersheds (ANAE/Bassins versants)
- Support to regional environmental management and the spatial approach (AGERAS)
- Biodiversity and applied environmental research (REF/Biodiversité);
- Secured local management of natural resources (GELOSE)
- Marine and coastal environment (EMC)
- Multiple-uses of forest ecosystems (ESFUM)

Crosscutting component:

- Policies, strategies and information, including EIA (PSI/MECIE).

Support components:

- Communication and education
- Program coordination (ONE)

Following the mid-term review of Environmental Plan 2 in June 2000 which identified over-complexity as a defect in Environmental Plan 2 design, the above components were reduced to the following:

Table 4.2. Revised structure of EP2 (June 2002)

Conservation of protected areas and ecotourism (CAPE)	Unchanged
Multiple-uses of forest ecosystems (ESFUM)	Unchanged
Conservation management of soils	Sub-component watersheds deleted
Support services to environmental management (SAGE)	Integrates AGERAS, GELOSE, EMC, and Biodiversity
Policies, instruments, and information for environmental management (PIIGE)	Integrates PSI/MECIE and REF
Communication and education	Unchanged
Co-ordination	Unchanged

Related activities to Environmental Plan 2

A full assessment of activities related to Environmental Plan 2 has not been conducted. It is, however, clear that numerous activities were encouraged or influenced by Environmental Plan 2 and contributed to the same overall objectives.

Among the significant activities during Environmental Plan 2 were:

- USAID's Landscape Development Initiative (LDI) project that has piloted agricultural intensification, forest management, and other means of addressing the threat of tavy
- Applied research on the links between biodiversity loss and development, especially the BEMA program (see below *)
- NGO conservation projects, e.g., Durrell Wildlife Conservation Trust, that have developed promising conservation approaches
- The national wetlands initiative, based on a consortium of organizations, which resulted in ratification of the Ramsar convention and the establishment of a national wetlands committee (CONARAMS); a project proposal for a national wetlands conservation program is being considered by GEF
- Environmental programs of QIT Madagascar Minerals (QMM) in relation to titanium mining near Fort Dauphin in southeast Madagascar; this development has in its turn attracted major investment by USAID and others in piloting a regional planning approach
- Initiative of the Ministry for Industry to establish a legislative framework for industrial pollution

Verreaux's Sifaka lemur at Berenty Reserve

- Moves by the shrimp fishing industry, led by GAPCM to establish special management zones, known as ZAC, for shrimp fisheries; discussions under way for a synergy with NEAP actors for the Baie d'Antongil, northeast Madagascar

*The Swiss-funded Ecological Inventory Project (BEMA) and Ecology Policy and Biodiversity project (EPB) have conducted applied research on the links between development, biodiversity, and slash-and-burn cultivation whose results have been debated in a national workshop (BEMA 2001). These, coupled with results of the USAID-funded LDI project constitute the most rigorous assessment of the links between biodiversity loss and rural development and will contribute to program design after Environmental Plan 2.

Results and lessons learned from Environmental Plan 2 and related activities

As for EP1, EP2 was the subject of annual or more frequent meetings of the committee of donors (CFE), which conducted reviews of progress to date. However, in the case of E2 the mid-way evaluation, conducted in February 2000, was an evaluation of the entire program.

More recently, the preparations for Environmental Plan 3 have necessarily involved an evaluation of the lessons learned during Environmental Plan 2.

NEAP mid-term evaluation

The NEAP mid-term evaluation (February-May 2000) yielded these principal conclusions:

Apart from significant results in the case of protected areas, an area especially supported by USAID, and soil conservation, the impacts of NEAP on the ground and for local populations have been quite limited — the goals of the Charter for Environment are still far from being achieved.

The main achievements of NEAP by the year 2000 had been:

1. Improvement of the institutional framework for management of the environment and natural resources

2. Development of a number of useful tools for environmental management, notably:

    - Environmental impact assessment (EIA) through the MECIE legislation (ONE)
    - National biodiversity strategy and revised law on intellectual property (ONE)
    - A new draft law on protected areas (COAP) and national protected areas plan (Plan GRAP) (ANGAP)
    - Modernization of the National Cartographic Institute (FTM), introduction of the land tenure "securitization" mechanism to support transfer of natural resources (SFR), the establishment of a corps of trained environmental-GIS technicians and a start to numerization of the national land register (cadastre)
    - Piloting of the regional approach (AGERAS) including conducting regional environmental assessments and establishment of local "structures for concerted action"
    - Transfer of management of natural resources through the various mechanisms of GELOSE, GCF (forests) and social conventions (*dina*)

3. The evaluation identified as positive the ability of NEAP to evolve, and noted in particular a shift in soil conservation projects from a local level to a larger-scale communal level, the shift in protected areas strategy to an ecoregional approach and the piloting of integrated coastal zone management (ICZM).

The main criticisms of the NEAP were:

- Inadequate communication — the NEAP was failing to communicate accurately or effectively with beneficiaries or between actors.

- The "program approach" has shown advantages and disadvantages but coordination of actions has been far superior than would be the case between separate projects — however, much progress was required in defining global indicators — state of environment, socio-economic indicators, biodiversity indicators — essential for impact evaluation.

The particular operational problems identified were:

- Obstacles to synergy between the different program components
- Excessive complexity of procedures
- Lack of coordination between NEAP and other national programs – poverty alleviation, rural development

Key findings of the mid-term review in relation to program themes

Forests

- Governance remains a major impediment, and donors made the improvement of governance a pre-condition of further support to ESFUM and the watershed components.
- Revenues of the National Forestry Fund (FFN) must be doubled and the management performance of FFN needs improvement.
- A monitoring system has to be in place to stop illegal forest exploitation on the East Coast (Toamasina) and in the north.
- No logging licenses should be granted by the Ministry of Waters and Forests for priority forest blocks until further validated management plans are elaborated and applied.
- The management capacity of decentralized forestry offices needs improvement.

Marine and coastal ecosystems

- The committee for marine and coastal protected areas must elaborate an action plan and feasibility studies to create four other marine and coastal protected areas.
- Micro-projects and community-based management activities should be launched on six pilot sites.
- Overall strategy of the marine and coastal environment component of PE2 will be clarified for the improvement of transparency

Further Environmental Plan 2 evaluation in the context of Environmental Plan 3 planning

The annual donor-government review process for November-December 2001generated additional recommendations in the areas of:

- Persistent problems of governance in the forestry sector (a series of pre-conditions were imposed on future Environmental Plan financing)
- Financial management — clarification required for the remainder of Environmental Plan 2 and the transition persion between EP2 and EP3
- Restructuring of ONE — the proposed restructuring based on the revised components of Environment Management Support Services Agency (SAGE) and *Politique, Instrument, Information pour la Gestion de l'Environnement* (PIIGE) should continue, with SAGE to be established as an autonomous body to become independent of ONE, which would retain the PIIGE function
- Global indicators of tavy and biodiversity must be defined

Note: Toward the end of Environmental Plan 2, data became available on rates of deforestation that confirm lower rates of deforestation in protected areas and classified forests than in non-classified areas, confirming at least that protected status confers a conservation advantage. A USAID-sponsored study has demonstrated lower-than-average rates of forest loss in forest corridor regions where USAID has been intervening through the LDI project (Hawkins & Horning 2001). However, the study did not consider the broader question of whether NEAP interventions as a whole were having an impact. For further details see the section on forests.

Environmental Program 3 (EP3 2003-2008)

Environmental Plan 3 is the “mainstreaming” phase of the NEAP. It is intended by the end of EP3 that environmental considerations become systemic and that the environmental “reflex” becomes automatic at all levels in society. Indications of the mid-term review are that these ambitious objectives will not be achieved in full by end EP3 while there is clearly much positive achievement to build from.

Key lessons emerging from NEAP that are adopted in the Environmental Plan 3 are:

- The need to address development and conservation at the local and regional level in a fully integrated manner
- The need for a fully coordinated, coherent, program approach; Environmental Plan 2 possessed many of the ills of the project approach despite best intentions
- The critical need to develop real capacity within communities to manage resources simple transfer of authority to manage is not enough

The proposed strategy for Environmental Plan 3 intervention is based on:

1. Adopting a results-based approach based on a single, coherent, logical framework, in place of the component/institution-based approach of Environmental Plan 2 — in theory this should render Environmental Plan 3 a more open, inclusive but coherent program than Environmental Plan 2, and encourage a greater degree of synergy between actors.

2. The program will operate at the national level — for addressing issues such as bush fires — while focusing field interventions at the level of zones of known priority for biodiversity (ZPIs);

3. Development planning and integration of the environmental dimension — NEAP would intervene primarily in the context of rural development, providing environmental input to PADR within ZPIs;

4. The guiding principles of intervention will be participation, subsidiarity, a regional and/or communal approach, a gender differentiated approach and empowerment.

The overall goal of Environmental Plan 3 will be to "conserve and derive benefits from natural resources for sustainable growth and improved quality of life." This goal by implication includes the alleviation of poverty.

The strategic objectives of Environmental Plan 3 are:

- Sustainable management of natural resources by communities in priority zones
- Promote sustainable management of natural resources at the national level

The specific objectives of Environmental Plan 3 are the following:

- Integrated development approaches adopted by the population focusing on ZPIs
- The potentialities of forest ecosystems are realized
- Conservation and enhancement of Madagascar's vulnerable ecosystems
- The potentialities of marine and coastal ecosystems are managed sustainably
- A positive change in behavior in relation to the environment is observed
- Mechanisms in place for sustainable financing of natural resources management and conservation

The expected results at the end of that third phase of the NEAP are that local communities from the priority intervention zones will have assimilated all renewable resources and biodiversity management techniques and principles, and that sustainable management of natural resources will be initiated at the national level.

The adoption of the regional (GTDR; see section on Rural Development Support Plan) and communal approach is expected to contribute greatly to the achievement of the two above results.

In relation to forests, the Environmental Plan 3 seeks to:

- Slow forest degradation through creation of new conservation sites and support to farmers' associations in bush fire and slash and burn control
- Manage forests in a rational manner through management transfers where the role of rural development working groups (GTDR) is fundamental
- Increase forest cover and improve the national capacity in storing carbon; the main mechanism for the achievement of this result is the creation of more Reforestation Reserves (RFR)

- Strengthen the forestry administration through the set up of an information and communications system, monitoring and evaluation of forest management activities, capacity building of participants in forest management.

The reinforcement of the link between rural development support and conservation is the most striking feature of the Environmental Plan 3. NEAP will thus be working mostly alongside PADR.

4.1.2 Political decentralization

Since the early 1990s Madagascar has been undergoing decentralization. This is a complex, politicized matter and many aspects remain unclear. Decentralization potentially has important consequences for environmental management.

The idea of political decentralization gained support from the early 1980s and was enshrined in the new constitution voted by referendum in 1992. The constitution called for "effective decentralization" based on the central state devolving administrative powers to regions and communes. Law 97-004 defined the powers of the regions and communes, although implementation only proceeded with the communes, each of which is led by an elected mayor.

Following re-election of President Ratsiraka in 1996, the constitution was revised in 1998 to introduce the new concept of the state of Madagascar as comprising the nation and six "autonomous" provinces. Laws were then passed to define the powers and roles of the autonomous provinces (Laws 2000-016 and 2000-017). Elections were held to appoint colleges of electors and elections held to appoint provincial governors in 2001.

Under the constitution, the state is responsible for international relations, justice, defense, national security, strategic resources, monetary matters, privatization of state enterprises and the guarantee of human liberties. The autonomous provinces are competent concerning the administration of the regions and communes, provincial administrative offices, police, markets, and public services of provincial interest.

The establishment of autonomous provinces is widely seen as a political device of the regime to facilitate presidential control through division, and indeed as running contrary to the original vision for decentralization. Supposing that the political crisis ends in establishment of a new regime, the status of autonomous provinces may be revised or even abolished.

Impacts of decentralization on environment

Decentralization has the potential for positive impacts on the environment, in promoting more regional and locally based management. The existence of autonomous provinces, however, may prove to be a threat or hindrance to regional and local management since the provincial administrations have authority over communes and regions.

Between the provincial and national levels, there is a risk of conflict resulting in a breakdown of rational management. Thus, provincial governors may be tempted to sell fishing or logging licenses against the wishes of central government, or the government may sell licenses for provincial resources. Such conflicts could have serious environmental consequences.

Between the provincial and the local and regional levels, there is a risk that the provincial authorities will use their powers to "re-centralize" management to the provincial level, even sweeping aside all that has been achieved in developing local will and capacity to manage natural resources.

USAID and other agencies have strongly supported the emergence of the commune as the optimal level of intervention for locally based resource management, with the communal development plan as the principal instrument for development and environment at the local level.

The inter-communal law should facilitate environmental management at the regional level, in the absence of any official regional administrative level (the regions as defined under 94-007 have yet to be put in place).

Nevertheless, there are risks associated with working at the communal level. The leaders of communes are elected politicians (mayors) who are linked through the national association of mayors. As long as the majority of mayors remain members of one political party, communes will be vulnerable to political interference.

Opportunities in view of decentralization

Opportunities under decentralization comprise 1) promoting desirable aspects of decentralization; 2) taking measures to compensate for the threats posed by decentralization.

One key opportunity of decentralization has been seized, namely the elaboration and passing of the GELOSE law. Many different actors have sought to apply GELOSE or simply to take the management of natural resources into their own hands through the customary law system (*dina*).

Another opportunity, which has been seized by donors and agencies, is to use decentralization to promote environmental management at the communal level. Empowerment of communes is a strategic measure to discourage future political interference by provincial governors.

In general, USAID and other agencies have made full use of opportunities offered by decentralization. The great challenge is now to provide decentralized agencies with the capacity to manage their resources correctly.

4.1.3 Structural adjustment

Structural adjustment constitutes the grand framework for macro-economic development.

The first structural adjustment loan (CAS1) was negotiated with the IMF in 1984 and operated until 1991 when the process was interrupted by a period of political instability. Negotiations resumed in 1994 and agreement on CAS2 was reached in March 1997. CAS2 funding came on stream during 1997.

Structural adjustment is directed from the Technical Secretariat for Adjustment (Secrétariat Technique d'Ajustement, STA) of the Prime Minister's office. The STA has published progress reports on structural adjustment (e.g., STA 1999).

The essential objective of structural adjustment is to bring about rapid and sustainable economic development through adjustment of the institutions, laws and policies that affect economic activity. A major emphasis is placed on market liberalization to facilitate economic growth. Measures are included to ensure that economic development is socially equitable and ecologically sustainable. Indeed, some of such measures are now an express condition of HIPC-II (see below) and are specified in the Strategy Document on Poverty Reduction (DSRP) (Government of Madagascar 2001).

Madagascar's structural adjustment has pushed through reforms in the following areas:

- Taxation and fiscal policy
- Monetary and financial sector
- Privatization of public industries
- Foreign exchange and payments
- Market liberalization

The program has had considerable positive economic impacts. Liberalization has encouraged a 750 percent increase in private investment between 1995 and 2000, which now represents 8 percent of GDP. Debt servicing costs were reduced by 50 percent by the year 2000. Economic growth in 2000 was 4.8 percent and was expected to be more than 5 percent in 2001. Economic growth overtook population growth in 1998 or 1999. A substantial dip can however was expected in 2002 because of the political crisis.

The reforms are also considered to have had reasonable success in terms to key social indicators, such as:

- Percentage of children *not* attending school reduced from 50 percent in 1993 to below 30 percent in 1999
- Illiteracy reduced from 56.6 percent of adults in 1993 to 48.7 percent in 1999
- Poverty index reduced from 73.3 percent in 1993 to 71.3 percent in 1999

However, performance on social indicators has been markedly inferior to performance on economic ones, indicating that many of the benefits of economic growth are not reaching the poorer population, notably the rural poor. As highlighted in earlier assessments of the private sector, only about five percent of the work force are active in the modern private sector while 9 out of 10 Malagasies remain in the informal sector (e.g. Coopers & Lybrand 1991).

The above findings led to the renewed emphasis on poverty reduction and the participation of the rural poor in the national economy, as manifested in the DSRP and PADR/PSDR, as well as in existing programs, e.g., NEAP.

Environmental impacts of structural adjustment

No specific assessment has been conducted of existing or potential impacts of structural adjustment on environmental indicators, while this has been the subject of much debate in international environmental circles since the mid-1980s. The environmentalist argument is that structural adjustment along free market lines, without mitigating measures, can be expected to accelerate rates of forest loss.

The evidence from Madagascar, based mainly on local studies (Freudenberger and Freudenberger, 2000), tends to suggest that at the local level, forest and biodiversity loss will rise with economic growth unless mitigating action is taken. This is primarily because increased prosperity enables wealthier individuals to hire labor for land clearance. While it is difficult to extrapolate from the micro- to macro-levels, there are no examples of any studies that show increased prosperity to have *reduced* deforestation rates.

The expectation that increased prosperity will increase rates of deforestation is echoed by the environmental evaluation of the PADR, which predicts that rural development will increase deforestation rates, necessitating a broad array of mitigation measures to counteract this tendency (CNRE 2001). A fuller analysis of the effects of prosperity on deforestation is given below in relation to the poverty reductions strategy (DSRP).

Opportunities under structural adjustment

In general, structural adjustment represents an opportunity for a whole range of measures intended to mitigate against the environmental impacts of economic growth and free market forces. Lobbying can help to ensure that such measures are imposed as conditions on structural adjustment, thus providing greater assurance of government for environmental programs. Such lobbying has had a considerable impact in Madagascar.

Opportunities exist in relation to specific adjustment measures. See below under HIPC, DSRP, PADR, and others.)

4.1.4 Enhanced Highly Indebted Poor Countries debt relief initiative (HIPC-II)

The Highly Indebted Poor Countries (HIPC) initiative was launched by the World Bank and the IMF in 1996 as the first comprehensive effort to eliminate unsustainable debt in the world's poorest heavily indebted countries. To mark the millennium, the initiative was broadened ("enhanced") in October 1999. An enhanced debt relief package was issued for Madagascar by IDA/IMF in December 2000.

Under HIPC-II Madagascar will benefit from a package of debt relief worth US$1.5 million (or US$0.8 million in Net Present Value) subject to certain key conditions:

1. Continued commitment of Madagascar to the structural adjustment program

2. Completion and satisfactory implementation of a fully participatory Poverty Reduction Strategic Paper (i.e., the *Document Stratégique de Réduction de la Pauvreté*, or DSRP)

3. Implementation of an agreed set of measures in the context of the DSRP, including key areas of governance, environment, institutional reform, social services delivery (health, education) and road maintenance

4. Confirmation of the participation of other creditors in the debt relief program

Links between HIPC and environment

The required environmental measures under N^{o} 3. above include implementation of a public and transparent information system on granting of licenses — beneficiary list, geographical zone, amount — in the mining, forestry and fishing sectors, with the list to be published biannually.

In relation to NEAP, the World Bank — supported by the other donors — has imposed a series of pre-conditions for continued financing of the NEAP in the area of forestry sector governance, namely:

Definition of working modalities for the National Forestry Fund (*Fonds Forestier National,* or FFN), Regional Forestry Funds (*Fonds Forestiers Régionaux,* or FFR)

- Publication of permits for forestry exploitation; while lists have been published during 2001, they did not meet the full requirements of transparency

- Precise reporting on the status of permits issued under CITES in view of Madagascar's having exceeded CITES quotas by massive margins, including reorganization of CITES authority and requiring all permits to be signed by the minister

- Implementation of a series of detailed conditions with regard to governance in the forestry sector, set out in CFE 2001

The above conditions, although not expressly tied to HIPC, may be regarded as having that effect since they elaborate upon conditions within HIPC-II.

Implementation of the HIPC-II will have substantial beneficial impact on Madagascar. Debt servicing costs as a percentage of government revenues was reduced from 25 percent in 2002 to as little as 10 percent in 2004; there was very strong political and economic incentives to meet the environmental and other conditions imposed.

Impacts of HIPC on the environment

Fulfillment of environmental conditions of HIPC should have a positive environmental impact in forestry governance and trade in endangered species. Unless conditions are further revised, an opportunity may be lost in relation to the marine resources sector, where there are severe governance problems on at least the same scale as the forestry sector.

Opportunities under HIPC-II

Opportunities exist to assist the Government of Madagascar in the fulfillment of environmental conditions under HIPC-II, especially in natural resources governance. Such assistance could be made conditional upon government engagement in other pro-environment measures that may go beyond government obligations under HIPC or other programs.

4.1.5 Poverty Reduction Strategy

Origins

The strategy document for poverty reduction (*Document Stratégique de Réduction de la Pauvreté*, or DSRP) (Republic of Madagascar 2001) was prepared pursuant to conditions imposed by IDA/IMF in the Highly Indebted Poor Countries debt relief initiative (HIPC-II) (IDA/IMF 2000). The DSRP is an integrated economic and social development plan in which poverty reduction is the central objective. The DSRP has become the reference instrument for other national programs in rural development, the environment, and others

Principal elements

The DSRP supersedes an earlier Framework Document on Economic Policy (*Document Cadre de Politique Economique*, DCPE) adopted in September 1996 and revised in June 1999 (DCPE for 1999-2001). The DCPE focused on poverty reduction but did not meet other requirements imposed by HIPC-II, in particular with regard to participation. The DSRP may now be considered as Madagascar's principal economic policy instrument.

The goal of DSRP is to halve the proportion of the population living below the poverty line from 70 percent to 35 percent by 2015.

The DSRP comprises three principal axes of intervention:

1. Improve national economic performance through participation of the poor
2. Develop social services — education, health, drinking water — and enlarge the social security net to reach the most vulnerable
3. Develop an institutional and policy framework that favors economic growth and poverty reduction, reinforce capacities to improve governance and optimize the interface between the administration and the administered.

Axis 1 integrates Madagascar's macro-economic policy that seeks strong non-inflational economic growth of around five percent based on attracting a high level of investment coupled with rigorous management of public finances with an effective fiscal pressure of 12.8 percent of GDP by 2003.

Participation of the rural poor in economic growth under Axis 1 is to be provided through implementation of the Support to Rural Development Plan (*Plan d'Appui au Développement Rural*, or PADR), a nation-wide program, of which the principal activities will be financed by the Rural Sector Support Program (*Program de Soutien au Développement Rural*, or PSDR), funded from a credit of about US$100 million from the World Bank. The PSDR seeks sustained economic growth of four percent within the rural sector, slightly below the desired national average of five percent. This is a "daunting challenge" for a sector that has been in overall decline in recent years (World Bank 2002).

Axes 2 and 3 comprise for the most part measures already foreseen within structural adjustment.

Links between DSRP and the environment

Under Axis 1, environment is addressed in relation to rural development in two respects: 1) the need for sustainable management of natural resources, and 2) the need for urgent parallel measures to conserve vanishing biodiversity that cannot await progress on rural development. Conservation of biological diversity is recognized as important for maintenance of the environment and environmental services. Mention is also made of the 50 percent of park entry fees used for development projects in villages adjacent to protected areas, which may be regarded as a direct benefit from biodiversity conservation and a contributor to local poverty reduction.

Under Axis 2, environmental quality for human populations is addressed in relation to health, drinking water, and urban pollution.

While sustainable management of natural resources is included in PADR and PSDR, measures to conserve biological diversity are not. These may be considered gaps in PADR/PSDR. A further gap is the omission of marine and coastal ecosystems from PADR/PSDR.

The absence of any stronger link between DSRP/PADR/PSDR and biodiversity conservation, or indeed any link between DSRP and NEAP, is perhaps a lost opportunity. However, NEAP donors, including USAID, and actors have helped to remedy this shortcoming through framing the objectives of Phase 3 of NEAP around poverty reduction and rural development, thus promoting integration between NEAP and DSRP/PADR/PSDR.

Potential environmental impacts of DSRP

The DSRP has not been assessed for potential environmental impacts. The Bruntland report (WCED 1987) promulgated the view that environmental degradation is largely driven by poverty. It would follow that measures to reduce poverty should reduce environmental degradation; however, there is a body of literature that supports the opposite view, for example, most of forest loss in Brazil has been caused by the ranching business.

A recent assessment of developing countries shows that poverty is not a good predictor of environmental degradation, while there are associations between environmental degradation and high populations of rural poor and between environmental degradation and a lack of agricultural diversification (Perrings 1998). For Madagascar, it has been argued that the country's unique agro-ecological diversity should confer a competitive advantage in an increasingly uniform globalized context (von Nieukoop, pers. comm.). Capitalizing on this potential should help to reduce rural poverty and conserve biodiversity.

Opportunities under DSRP

There is an opportunity to complement DSRP with measures that mitigate against potential negative environmental impacts of DSRP, or improve DSRP's environmental performance. This would suggest working at the same levels as DSRP, from the policy level down to direct support to rural enterprise.

Opportunities exist to complement the PADR and PSDR with measures to support ecologically sustainable rural development such as eco-certification of agricultural products,

ecotourism and rurally based environmental enterprise that promotes biodiversity conservation.

4.1.6 Rural Development Support Plan (PADR), including PSDR and PDR

To redress its economy, Madagascar is undertaking a series of structural adjustment measures. In this context, the framework document of economic policy (*Document Cadre de Politique Economique*, DCPE) was revised in 1999. The DCPE stipulates that the agricultural and rural development strategy (PSDR) should be reinforced by a rural development action plan (PADR) stretching throughout five years. The latter was institutionalized through Decree 99-022 in January 1999.

Getting water from Mandrare River, Amboasary

The PADR is a conceptual, a defining and orientation policy framework for all rural development strategies and programs. The objectives and orientations of the PADR are to:

- Achieve food security
- Contribute to economic development
- Reduce poverty and improve rural livelihoods
- Promote the sustainable management of natural resources
- Promote training and information to improve agricultural production in rural areas.

Moreover, five sub-themes to the above objectives have been identified:

1) Ensuring good management of rural areas through institutional reforms. This basically consists of putting into place legal structures that favor of rural development.
2) Promoting private sector partnerships to modernize rural production systems, diversify production and export products, and develop some sustainable financing mechanisms for rural areas
3) Increasing and promoting agricultural production through optimal use and sustainable management of resources and infrastructures — use of appropriate techniques, organization of producers, improved management techniques
4) Ensuring sufficient food supplies for all regions — improvement of transport infrastructure, community barns, and so forth
5) Improving social services infrastructures and facilitate access to them — drinking, water, clinics, schools, improved housing

For operational purposes, Madagascar has been divided into 20 agro-ecological regions and rural development working groups (GTDR) were appointed in each of these regions. Each GTDR consists of farmers' groups, private sector people, decentralized authorities, projects and programs working in the region (NGOs included), decentralized rural development ministry offices. The GTDR are key elements in the regional approach of the PADR. The functions of the GTDR include:

- Conducting an inventory of projects and programs in their region
- Creating a communication/monitoring network with these projects and programs
- Assessing the needs of the region in terms of rural development and giving these needs priority in the context of a regional development program (PRDR)
- Identify activities and projects needed for the launching the PRDR, which can be submitted to donors for financial support and included in the public investment program (PIP), or put into operation by the private sector.

A series of projects and programs operate under the PADR. Among them, the World Bank-funded support to rural sector development project (PSDR) and the Swiss-funded rural development program (PDR). Before the PADR was implemented, an environmental assessment of the PADR was required, whose results were complied in a three-volume document:

- Volume 1 presents the environmental context (Environmental Plan 2) in which the PADR will be operating; the environmental context of the EP2 is described throughout the present assessment, and we will avoid repetition.

- Volume 2 assesses which sub-sectors of the rural development program will need substantial investment; six key problematic areas were identified:
  - Degradation of natural resources and habitats
  - Access to water
  - Soil degradation
  - Land insecurity
  - Poor management of natural resources
  - Decision-making that is too centralized

The Rural Sector Development Project (PSDR)

The PSDR responds to the World Bank's interest in promoting more innovative approaches to rural development in favor of economic growth and poverty reduction. The Bank's rural strategy for Madagascar seeks to be "comprehensive, poverty-focused, with support for demand-driven projects implemented through decentralized and more efficient mechanisms." (World Bank, 2001) The PSDR aims to encourage farmers to participate more actively in decision-making and financial contributions toward implementation. PSDR will focus on three major objectives:

1. The improvement of the economic and institutional enabling environment through an assessment of the impact on the poor of import taxes and VAT on agricultural inputs, a review of the regulatory and legal framework for the private sector, and most important, the strengthening of institutional arrangements at the national, provincial levels and in the PADR's intervention regions
2. The promotion of partnerships in rural development with the private commercial and non-profit sectors
3. the promotion of sustainable growth of agricultural productivity and reduction of rural poverty. The creation of an Agricultural Productivity Fund for the support of technology generation and dissemination is proposed.

The Rural Development Program (PDR)

Initiated in 2001, the PDR is 28-billion FMG Swiss program to reduce poverty and improve livelihoods of rural people in three key agricultural areas. To achieve that general objective, the PDR sets out to:

- Strengthen the organizational capacities of rural people
- Increase rural households' revenues through increased productivity, the sustainable management of production systems, improved access to markets
- Support communities in their efforts toward social services' improvement
- Integrate rural communities into the market through better communication and access to information.

The originality in this program is that it is based on decentralization in decision-making by the rural communities, which makes it an empowering approach. In the PDR context, private and public institutions provide services to rural communities through contracts.

4.1.7 Climate Change Convention program

Introduction

The Framework Convention on Climate Change (FCCC) provides a framework for international cooperation to reduce greenhouse gas emissions and manage impacts of climate change.

Madagascar signed the FCCC in 1992 and ratified in December 1998. Unofficially, Madagascar intends to sign and ratify the controversial Kyoto Protocol and has a strong wish to participate as a host country in the Clean Development Mechanism.

In September 2000 a GEF-funded project, administered by UNDP and UNOPS and under the Ministry of Environment, was launched to enable Madagascar to prepare its first communication to the CCC (Project MAG 99 G31), with funding of US$350,000 during two years. This project should culminate in a national plan of action in November 2002.

As a first stage, an inventory has been conducted of greenhouse gas sources and sinks, currently in draft form. Because of the low degree of industrialization, principal emissions are from the agricultural sector and, in particular, from forest clearance and bush fires.

Following a preliminary review of Madagascar's vulnerability to climate change, the national CCC project opted to evaluate five sectors for potential impacts and adaptation measures – forests, coastal zones, agriculture, water resources, and public health. Reports in these sectors are near completion. It is noteworthy that the energy sector has been omitted in this review, since this was considered more a domain for measures in mitigation.

Impacts of climate change in Madagascar

Analysis of meteorological data since the early 1900s indicates that average temperatures have increased by 1° Celsius during the last 100 years, while overall precipitation has not changed significantly. However, there have been considerable variations in patterns of rainfall — seasons, distribution — that remain to be fully investigated. As an example,

rainfall over Madagascar's most important offshore island, Nosy Be, has diminished by about 30 percent since 1960 possibly due to deforestation. There is also evidence of climatic anomalies in the south of Madagascar causing droughts that can be linked to perturbations in oceanic currents (Jury et al., 1995; Reason & Lutjeharms 1998).

There is global recognition that climate change may be linked to an observed increase in the frequency of El Niño events in recent years; in association with these events, Madagascar's coral reefs suffered severe bleaching in most areas except the northwest in 1998 and 2001.

Studies of rising sea level are underway through a collaboration between the Institute of Marine Science in Toliara and the University of Marseille. There are concerns that degraded coral reefs, such as the Grand Récif of Toliara, will fail to keep pace with sea level rise, thus leaving the coastline less protected from waves. Other impacts of sea level rise will include increased coastal erosion in areas already affected — Tomasina, Morondava — and the potential loss of mangroves, important for the reproductive cycle of penaeid shrimps — Madagascar's major fisheries export. Indeed, Madagascar can expect to lose large areas of valuable intertidal habitat along its western coasts as well as a decline in the area of viable coral reefs.

Elements of the CCC program

The current CCC program aims to develop a national plan of action under the CCC, to be prepared in the near future and presented officially in November 2002. It is premature to predict the contents of such a plan, but activities envisioned include:

- Reinforcement of Madagascar's program in forest conservation and reforestation, including in Madagascar's mangrove areas, under the Kyoto mechanism
- Reinforcement of coastal zone management measures to take account of sea level rise, sea temperature rise and increased impacts of cyclones
- Developments in agriculture that take account of climate change
- Measures in the water sector to ensure continued security in water supplies
- Research and other measures in the health sector to be prepared for the effects of warming, e.g., increased incidence of malaria to cooler areas; greater problems of infantile dehydration, among others

Opportunities under FCCC

Opportunities exist to support Madagascar's responses to climate change in the five sectors identified and other sectors as appropriate.

With regard to the Kyoto protocol, it is acknowledged that USAID interventions may be limited in view of its stance in relation to the protocol.

Within or without Kyoto, opportunities exist to support private sector development of energy production, including artisanal wood production from community-managed forests. Links exist between forests, watershed protection,n and options for hydro-power.

Within Kyoto, opportunities exist for the implementation of the Clean Development Mechanism and, in particular, putting in place a favorable environment for carbon credit transactions.

4.1.8 Sectoral policies and programs affecting key resources and their management

Forestry

The first national forest policy was adopted in 1985; it had been elaborated in accordance with economic priorities of the time — improve the balance of payments and achieve food security. However, that forest policy did not lead to a reduction in forest degradation or to the optimal use of forest resources. Major institutional issues were also unresolved.

As new economic priorities were defined under the successive structural adjustment programs, a new forestry policy (POLFOR) was adopted 1995, on which the national forestry plan (PDFN) is based. This policy evolves around four main interlinked objectives:

1. End the forest degradation process by:

    - Supporting alternative practices (to *tavy)* in rural areas
    - Contributing to bush fire management and control
    - Preserving forest heritage and ecological balance

2. Improve the management of forestry resources through:

    - The elaboration of forestry resources' management plans
    - The rational exploitation of forestry resources
    - The reorganization of the revenue generation system of the sector

3. Increase the forest cover and its potential by:

    - Promoting reforesting activities
    - Ensuring land security for those who reforest
    - Reforesting according to regional and local needs
    - Intensifying activities related to watershed management

4. Improve the forestry sector's economic performance through:

    - The promotion of forest products
    - The improvement of the functioning of marketing networks
    - The promotion of ecotourism (IEFN, 1996)

Four technical offices are in charge of putting each of the above activities into operation.

Fisheries

Fisheries sector policies and programs are notable for a relative lack of consideration for sustainability.

In the early 1980s surveys by FAO estimated that Madagascar's fisheries' stocks could sustain an off-take of around 330,000 tons annually, based on a generalized model for estimating sustainable yield as a fraction (23 percent) of the standing stock biomass

(Andrianaivojaona et al., 1992). Since total estimated exploitation was then only around 60,000 tons, the perception arose that stocks were in no immediate danger of over-exploitation. Fisheries policy thus aimed to increase production, particularly of "under-exploited" stocks.

In the early 1990s, Madagascar's fisheries' legislation was revised. In keeping with greater global awareness of the need for sustainability, the Law (93-022) stipulates that fisheries and aquaculture should be conducted in an ecologically sustainable manner. In 1996, the Ministry for Fisheries commissioned the preparation of a strategy for ecologically sustainable fisheries (Orgasys, 1997) but this was never adopted. It has, however, issued a code of conduct for aquaculture to be promulgated as a national law. In essence, the policy of increasing production has remained and the Ministry for Fisheries has been active to promote fisheries as the fastest growing primary sector generating substantial hard currency revenues.

To date, the fisheries ministry has been primarily concerned with the development of industrial fisheries for tuna and shrimp, for other high-value products such as lobster and sea cucumber, and for shrimp farming. The fisheries ministry, however, has undertaken few measures to ensure the sustainability of these activities. Thus, there has been no enforcement of catch reporting requirements for tuna fisheries — the official catch for Madagascar's EEZ was reported as exactly 10,000 tonnes for most of the last 10 years. For shrimp, the ministry has actively encouraged the use of non-selective gears and requires trawlers to land a minimum quantity of fish by-catch — for free distribution to local communities. The ministry has declined to introduce turtle excluder devices on the basis that the EU does not require it. Sea cucumber fishing is continues uncontrolled and permits have been issued to semi-industrial operations that illegally use scuba gear — with many diving accidents.

Donors, on the other hand, have shown interest in developing traditional fishing for reasons of food security and poverty reduction. Thus, FAO, with UNDP funding, has implemented a substantial traditional fisheries development project at two levels: 1) national monitoring for traditional fisheries, and 2) local support to fisheries development focusing on treatment and marketing techniques. FAO is preparing, with financing from the African Development Bank, a major traditional fisheries development program for the entire coast between Toalagnaro in the southeast and Maintirano in the northwest. A proposal to collaborate exists between Environmental Plan 3 of NEAP and PADIL in priority coastal areas as designated by NEAP in marine and coastal biodiversity where emphasis would be on achieving sustainability in small-scale fisheries.

The private sector and donors have been seeking to improve sustainability of the industrial fisheries sector. Thus, the association of shrimp fishing and aquaculture operators (GAPCM) has supported establishment of a national shrimp fisheries research program to monitor stocks and has pushed for introduction of a new economic monitoring unit for improved efficiency. Research shows that the shrimp fishery is exploited close to its sustainable limits and a moratorium has been called on the issuance of new licenses. In a new program being launched, GAPCM with financing from the French Development Agency (AFD) will seek to promote special shrimp fishing management zones and the introduction of selective trawls.

Within the context of structural adjustment, the World Bank has funded the development of a revised non-arbitrary permit system for shrimp fishing. This should increase official revenues substantially permitting their reinvestment in better management.

The EU has financed a new fisheries surveillance program that has been arresting illegal and unlicensed vessels and policing the sale of undersized products. All shrimp and tuna vessels are now tracked by satellite and infractions recorded and regulations enforced. The EU project plans to help establish a permanent and autonomous fisheries surveillance agency.

Major improvements are required in the less formal commercial sectors such as sea-cucumber fishing — now practiced on an industrial scale without any controls — shark fishing, mainly artisanal, and fishing for ornamental shells. On the positive side, efforts are being made to improve the management of lobster fisheries through a system of community-based management using the GELOSE Law (96-025). ICZM, typically integrating "no-take zones" and local enforcement of fisheries regulations, shows considerable promise as a vehicle for promoting sustainability of small-scale fisheries, although ICZM policies and instruments are not yet in place.

Agriculture

The agricultural sectoral policies evolve around five main objectives:

1. Improve rural livelihoods through the increase of farmers' revenues — diversified, intensified and better-quality production, more substitution and export crops, conservation and improvement of cultivated lands' fertility
2. Improve productivity by rehabilitating irrigation networks and infrastructures, making beneficiaries participate, establish community infrastructures
3. Open markets by creating a favorable environment for farmers' organizations, by enabling rural finance transactions
4. Enhance resources' value
5. Protect the environment

Regional and inter-regional offices — decentralized structures — have been created to put the above objectives into practice.

Energy

The structural adjustment program includes these measures relevant to the energy sector:

1. Privatize the petroleum sector — break-up and sale of national petroleum company SOLIMA and of the national energy distribution company JIRAMA
2. Improve the efficiency of the petroleum sector and the electricity sector
3. Adopt an energy policy that is ecologically sustainable with the promotion of alternative energies to preserve forest resources
4. Revise legislation on making investments compatible with the environment —including energy projects

Objectives N^{o} 3 and 4 are found within the environmental objective of structural adjustment, or ecologically sustainable development.

Reform of the energy sector is the responsibility of the Ministry of Energy and Mines. Phase 1 of the Energy Project (1998-2001) included a pilot operation in Mahajanga, a large coastal town. There were three major conclusions:

1. The energy sector needs to be liberalized while the national electricity distribution company JIRAMA should exploit and maintain the state infrastructure — power lines and others
2. Alternative energy sources, including renewables, should be promoted — generators, hydropower, biogas, wind, wood, solar
3. In light of the Mahajanga experience, the large demand for energy from wood should be met through tree plantation management, including using GELOSE for local management. PSDR includes funds for wood fuel plantation development, including mangrove management as a wood fuel source.

Mines

The structural adjustment program, with regard to the mining sector set out to enhance the potential of the mining sector. To reach that objective, the following sectoral policies were carried out in 1999:

- Prepare and publish decrees — such as the Law N^{o} 99-022 — supporting the application of the new mining code — Law N^{o} 95-016 of September 1995, delimiting authorized mining sites, defining mining, mining permits, the rules for obtaining them
- Adopt a law on investments of more than US$200 million
- Process at least 80 percent of the mining permits at central Mining Cadastre Bureau
- Make OMNIS — institution for the promotion of the mining sector, as well as a geological information bureau — operational.

An interministerial order on environmental regulation within the mining sector was elaborated and published and adopted in 2000. The creation of the Mining Cadastre Bureau was planned for May 2000.

Ft. Dauphin new port construction

Transport

In the context of economic readjustment, the transport sector was identified as a tool to reduce poverty and a field of opportunity for the direct application of economic liberalization. It is expected that the transport sector will lead to an increase in overall production, the development of tourism and a facilitated access to mining resources (CNRE, 1999).

The figure below represents the transport infrastructure that exists in Madagascar. The Transport Sectoral Program (PST) determines the transport sectoral policies, which aim at:

- Restructuring the sector
- Promoting the implication of the private sector through decreased state intervention in planning, legislating and monitoring of the sector's activities
- Improving planning and accounting

- Increasing the sector's financing abilities to maintain infrastructures; this includes the set up of a cost recovery system for the sector
- Involving the targeted communities

The PST will be implemented in four phases, in accordance with an Adjustable Program Lending system; here is what the four phases will deal with:

- Restructuring the sector by rehabilitating and maintaining the priority transport network in good conditions, with attention to port and river infrastructures
- Rehabilitating the secondary roads and the railway
- Creating or improving secondary rural roads including communal and village roads
- Ensuring good maintenance of overall road and port infrastructures. (CNRE, 1999)

Population

Sectoral population policies are inspired by the National Population Policy, which dates from December 1990, and is supported by Law N^{o} 90-030. The objectives of the policy are to:

- Eliminate social, political, and economic constraints to the well being of the Malagasy people who are key protagonists in the development process
- Reduce the morbidity and mortality rates, especially of mothers and children
- Reduce the fertility rates, so that the exponential population growth — in relation to economic growth — is halted.

For each of the above overall objectives, strategic objectives were elaborated.

The promotion of education and fulfillment of basic needs — by provision of food, shelter, clothing, employment, health — is a priority strategic objective for objective N^{o} 1 above.

Reach a life expectancy of 60 years, and reduce child mortality rate from 120 per 1,000 to 70 per 1,000 is the strategic objective under general objective N^{o} 2.

For objective N^{o} 3, facilitating access to affordable family planning, providing each Fivondronampokotany (district) with a specialized family planning service, and reach a two percent per annum population increase rate by the year 2000. The latter objective has not been reached, because, according to the World Health Organization, the population increase rate in 2000 was 2.9 percent. (OMS, 2001). The above population policies go hand in hand with health sectoral policies.

Health

The structural adjustment program includes these measures for the health sector:

- Increase real per capita public expenditure, especially operational costs
- Allocate funds to sanitary districts, based on efficiency criteria
- Redistribute human resources evenly across the country; this includes hiring more paramedical staff and assistance in providing better quality health services
- Finalize the framework for cost recovery in basic health center and elaborate a similar framework for hospitals

- Ensure that the system is financially autonomous
- Help SALAMA become financially independent by ensuring that benefits generated through product marketing are directly reinvested in SALAMA's activities.

Impacts of past events and current initiatives

The preceding analysis of past events and current initiatives has highlighted the following impacts:

- *The National Environmental Action Plan, Phases 1 and 2* have made substantial progress in achievement of its specific objectives, but the mid-term review indicated that the program had had little impact so far on the behavior of populations or on the overall rate of environmental degradation. Data emerging subsequently have been more promising, suggesting that deforestation in protected areas and classified forests is substantially lower than in unprotected areas, but still significant (0.6 percent or greater) and that rates have been lower in areas where USAID's LDI projects have been promoting agricultural intensification. As yet, there is no evidence that such impacts would be sustainable once funding ends. Further extension of the national protected areas network is required if a representative sample of Madagascar's biodiversity is to be conserved. Limited progress has been made so far with sustainable financing of environmental management and conservation.

- *Political decentralization* has greatly facilitated the development of decentralized tools for environmental management and transfer of management to the local level through legislation such as GELOSE but also through conferring "legitimacy" to decentralized forms of management, such as *dina*, even where those mechanisms may not yet enjoy full legal recognition. However, considerable confusion remains over the status of the autonomous provinces, which may even threaten initiatives at the national and local levels through concentrating too much power with the provincial governors.

- *Structural adjustment* has promoted economic growth but with most of the impact on the secondary and tertiary economic sectors, mainly based in cities, and with little impact on the primary sectors of production such as agriculture. Furthermore, few benefits trickle down to the rural poor who depend on subsistence agriculture including *tavy*. The links between poverty and environmental degradation is still poorly understood although evidence suggests that improved prosperity in rural areas may accelerate deforestation by generating cash to pay for labor.

- *The HIPC debt relief initiative* will undoubtedly assist the Malagasy government in achieving its development goals, adding to the benefits of structural adjustment while not having significant further impact on the rural sector.

- *The poverty reduction strategy (DSRP)* and the rural development plan (PADR) provide the framework for rural development although success depends on the response of rural communities to the opportunities presented and that of the private sector seeking partnerships with those communities. There is a risk that the rural development plan will become overly administrative, delivering limited economic impact, or that its economic success will increase deforestation.

- *Activities under the Climate Change Convention* are at an early stage and are having no impact on the environment. However, in the future, Madagascar's participation in the convention and the Clean Development Mechanism may ultimately free up funding for forest conservation and plantation programs that would have a positive environmental impact and guaranteed sustainable financing, depending on how the Kyoto protocol and international carbon markets evolve.

- *Sector policies* are now mostly taking account of the environment, although in reality there remain major governance problems, especially in forests and fisheries. Integration of forests into the environment ministry promises to facilitate the shift from a production to a conservation orientation and a rationalization of the forestry sector. Agricultural policy is effectively the PADR referred to above. Population is a key area, since slowing population growth, along with other measures, is critical if deforestation rates are to be reduced to sustainable levels. Transport policy may need to take into account the impact of roads on deforestation. Energy policy is evolving in the light of environmental considerations.

4.2 National Initiatives

By far the highest impact program in the environmental sector has been the National Environmental Action Plan. Instituted in three phases — EP1, EP2, EP3 — during the past 15 years, it has represented a national investment of more than US$450 million, employed directly and indirectly thousands of people, and affected the lives of several hundred thousand more. In addition to the experience gained and the knowledge learned through its efforts perhaps the most significant contribution of NEAP has been its bringing together of stakeholders, professionals, donors, entrepreneurs, farmers, fisherfolk, and countless others. It has had a substantial leverage effect, encouraging many related activities pursuing similar objectives not formally a part of the plan, and added considerable value to the conservation and protection of the nation's natural resources.

In 2008 the final phase of a legacy, Environmental Plan 3, will finish with a long list of accomplishments, valuable experiences, and lessons learned. The plan had its share of weaknesses and shortcomings but all have provided a solid foundation for the Malagasy government's bold new initiative, the Madagascar Action Plan (MAP). The MAP's objective is directive and precise and it combines both the environment and the economy. Where the NEAP has been more institutional with an emphasis on legislation and administrative detail, the MAP is geared to decentralization, public and private partnerships, and a holistic approach with a management by objective undercurrent. Assigned responsibilities, accountability, realistic targets and deadlines for meeting them are part and parcel of this newest initiative.

During the NEAP's implementation, environmental actions and initiatives did not have to be in tune with the Environmental Plan, whereas with the MAP, a country strategy led by the government, all environmental actions, in fact all sectors, are expected to fall in line/adapt. The fact that this is a voluntary obligation may erode some of the MAP's long-term impact.

The experiences and lessons from the NEAP are evident in many parts of the MAP. The latter is just in its start-up phase and its shortcomings will become more evident in the next year or so. How realistic the indicators are will become evident as activities are initiated and monitoring measurements are collected. Obtaining financing, especially for ongoing

maintenance and administration of programs on conservation and protection of the environment (Commitment Seven), faces critical tests. The first challenge to increase the total amount of terrestrial and marine areas under protected area status is bold, given the paucity of institutional capacity to manage and maintain them — with human as well as financial resources — once they are officially declared and delimited "on paper." The other challenges, 1) reduce natural resource degradation, 2) develop an environmental reflex at all levels, and 3) strengthen forest management effectiveness, are equally formidable.

This is not meant to detract from the MAP as it is a significant initiative: it is a visionary and aggressive step. The government has created enthusiasm and a greater awareness of each of its eight commitment areas that are far-reaching domestically toward Madagascar's populace, and with worldwide marketing to secure support and funding. Initial results are positive.

More unique to the MAP in comparison to prior strategies is the fact that this is a wholly government-led effort. The private sector, donors, NGOs and others are all encouraged to become significant players and each has a definite and planned role. But it is obvious that it is the government that has taken the lead.

Kelilalina Koloherena president explains activities to the ETOA team

4.3 USAID Programming and Investment

USAID/Madagascar has long been an active and avid supporter, and a significant donor, of activities that have promoted Madagascar's unique biological heritage. For more than 15 years, it has worked with government ministries, NGOs domestic and international, the donor community, and the private sector to help protect, conserve, and wisely manage the country's biodiversity and tropical forests. USAID has been a valued partner to the Malagasy government's implementation of the Environmental Plan in each of its phases. USAID is an active counselor and participant in the MAP efforts within the country and on the world stage. During the ETOA update it was acknowledged repeatedly that USAID/Madagascar has been a primary champion and recognized leader of the environmental community in the country. This recognition has come as the result of dogged persistence and belief in several principles that have been learned and modified during several programming cycles. And this has happened in the face of budget cutbacks and significant reductions in support staff.

4.3.1 Environment-Rural Development Program (SO6)

USAID/Madagascar's biodiversity and tropical forest conservation efforts fall within Strategic Objective (SO) 6. The objective is to "conserve biologically diverse forest ecosystems" by improving sustainable natural resource management and environmentally sensitive development. Activities under this SO take a holistic approach to sustainable forest and ecosystems management. In addition to activities under SO6, USAID helps to implement

a PL 480 Title II Food for Peace program that works to improve vulnerable people's food security in synergy with and under common goals as the environment and rural development program. To maximize returns on investments the Mission consciously works to develop other sector programs — e.g., health, population and nutrition which comprise SO5 activities, democracy and governance and agriculture — within the same regions. This results in staff support roles across sectors. Some SO6 staff are engaged in emergency response activities.

The number of activities overseen by SO6 staff is substantial and liaison with the government and other donors is demanding. Budget cuts and reductions in force have reduced full-time staff to three, a number that is not sufficient to effectively manage all program activities and maintain the valuable leadership role in Madagascar's environmental community. USAID's investments have been very effective and have had a visible and positive role recognized as a leader in biodiversity and tropical forestry conservation. Hopefully the next integrated strategic plan will value the past investments and reinforce USAID's role in the sector.

4.3.2 The eco-regional approach

Many of USAID/Madagascar's successes throughout the past 10 years can be attributed to its programming based on the premise that sustainable rural development is inextricably linked to natural resource management, biodiversity conservation, water quality and availability, economic growth, health, local stakeholder engagement, and capable, good governance. The Mission's program is focused on achieving complementary goals of increased agricultural production, improved livelihoods and food security and decreased threats to natural resources and biodiversity, with biodiversity resources allocated within this element. Started in 1997 to achieve greater impact, a landscape approach was developed allowing the concentration of resources within areas. Initially this was done in the Mahajanga, Toamasina (Moramanga) and Fianarantsoa regions. Today, the focus is predominantly in the latter two regions in separate humid forest corridors; the region around Taolagnaro in the south has been receiving USAID attention and investment in recent years building on the experience gained in the other two regions.

The long-term presence in the Moramanga area and in Fianarantsoa in particular, has been extraordinarily valuable. The fact that key individuals have remained in place has been a luxury that has provided USAID and Madagascar with perceptions that add considerable valuable to the development investment. The cultural, farming and other livelihood practices have become better understood along with the importance of market and transportation linkages and their direct bearing on the threats to the forests and biodiversity in the two forest corridors. As a result USAID has been able to adjust its programming to better respond to these threats as well as to engage regional decision-makers, other donors and NGOs to develop better regional plans and undertake more effective activities.

Due to these inter-relationships and linkages between program elements with the USAID Environment, Rural Development and Food Security portfolios, USAID put into place the Eco-Regional Alliance in October 2003 as a coordinating structure made up of USAID implementing partners and other partners. It serves to coordinate interventions for maximum impact of activities. Key elements of the Alliance include a common vision, common indicators, shared leadership, coherent program implementation, and complementary areas of expertise. The Alliance serves local populations, elected and traditional authorities, the private sector, and government agencies. Alliance members work to ensure harmonization of USAID-funded activities and government priorities by developing planning tools, ensuring

links between conservation and development, and promoting multi-sector and multi-level collaboration.

The Alliance appears to best serve the contractors engaged in implementing USAID's programming. Its long-term effectiveness in the regions is apt to be dependent on each individual *chef de région*; during the assessment its effectiveness was lauded by many in the environmental community, but its durability in the regions where it operates, if funding shrinks or is withdrawn, is questionable. Box 4.1 provides a brief description of activities implemented under several contracts within the Alliance.

Box 4.1 The key partners in USAID's Eco-Regional Alliance

Eco-Regional Initiatives. The goal of the Eco-Regional Initiatives (ERI) contract is to transform rural natural resource use and agro-ecological systems to improve the social and economic well-being of rural population and conserve habitat in and around critical forest corridors. The program emphasizes the development of a shared strategic vision, partnerships, and alliance building to mobilize and target resources within the two critical eco-regions, one near Toamasina, the other near Fianarantsoa. Its focus is to provide alternatives to slash and burn agricultural practices and improve community-based natural resources management. The program focuses on: (i) establishing viable platforms to ensure good governance of natural resources; (ii) transferring management of two newly created protected area corridors to community-based organizations; (iii) mobilizing productive and environmentally sound farming systems to replace slash and burn agriculture through a farmer-to-farmer approach; (iv) mobilizing rural farmer associations to achieve financial and organizational sustainability and become effective advocates for local issues; and (v) establishing an effective rural-based communications network as a vehicle toward behavior change.

Jariala. The goal of this contract is to achieve effective stewardship and management of Madagascar's forest ecosystems. The program supports the establishment of enabling conditions, with a focus on restructuring and revitalizing public sector environmental and forestry institutions. Activities focus on: (i) restructuring and revitalizing the Malagasy Forestry Service through human resource reform and improved management of forest sector budgets; (ii) fostering investment and partnerships for managing plantations in 1,220 ha; (iii) engaging multiple stakeholders and interest groups to improve environmental governance, stewardship and control in forest districts; (iv) developing fiscal framework and master plan and provide training for sustainable fuel wood production in Anosy region; (v) improving the use of environmental impact assessments and information for land use planning and decision making in seven regions; and (vi) facilitating environmental mainstreaming by reconciling forest production, conservation, and mining objectives through effective land use planning.

Miaro. The objective of the Miaro program, implemented by international conservation organizations, is to maintain biological integrity of critical biodiversity habitats. Activities focus on expanding biodiversity habitat conservation by creating protected areas to maintain ecological linkages, developing and implementing tools to ensure protected area management effectiveness, and stimulating investment for biodiversity conservation through Malagasy Environment Foundations. The program strengthens enabling conditions for the long-term success of biodiversity conservation by: (i) supporting Malagasy institutions and their partners with the tools and capacity to increase the protected area network by one million hectares; (ii) defining and implementing viable structures for community co-management of new protected areas in three priority eco-regions; (iii) improving management effectiveness to conserve biodiversity in the national park network; and (iv) creating the legal, economic and policy framework for sustainable conservation financing. These conditions will lead to improved conservation of biodiversity, through investment in new protected areas and improved management effectiveness of the network.

Bamex. The goal of the Bamex program is to assist rural farmers in moving from a subsistence to a market-led agricultural economy aimed at alleviating poverty, improving livelihoods, and reducing pressures on the natural resources base. The program ensures linkages between small farmers and agribusiness in two USAID priority forested eco-regions. The program seeks to help rural farmer associations identify profitable outlets for agricultural and natural resources products available at the local level by combining a demand and supply-driven approach. Bamex focuses on: (i) increasing productivity and quality to boost the competitiveness of five value chains (litchis, coffee, red rice, jatropha, and aromatic and medicinal plants); (ii) identifying markets and buyers on a demand-driven basis for products commercialized by small farmers; (iii) improving the ability of farmer associations to respond to market requirements and strengthening the operational linkages between stages in a value chain; (iv) increasing the capacity and use of business and financial services; and (v) finalizing a regulatory framework for seeds and fertilizers.

U.S. Forest Service. An Inter-Agency Agreement between USAID and USDA Forest Service International Program provides a strong partnership to assist the Malagasy Forest Service in improving forest management and use of forest products for revenue generation. USFS provides assistance in the fields of forestry-related

Box 4.1 The key partners in USAID's Eco-Regional Alliance (continued)

training, capacity building, technical assistance and policy and strategic development. USFS provides assistance in: (i) remobilizing sustainable forest product harvesting through skills-based training in forest inventory techniques, elaboration of management plans, and use of competitive bidding for forest use permits; (ii) implementation of a new forest law enforcement system, including the establishment of a chain of custody for improved governance of illegal logging; (iii) promotion of private sector investment in reforestation and pine plantation management in three priority eco-regions by assisting in the development of viable business plans and procedures for forest-use permit allocation; (iv) finalization of forest zoning plans as a tool for making decisions about forest use; and (v) information management at the national and regional levels.

Funding for the contracts with the Alliance ends officially with the 2008 fiscal year. USAID has stated unofficially that additional financing for most of the contracts will be available to help carry the activities into the next planning cycle. Each contract has ambitious goals and their activities have proven effective in achieving positive impacts locally, regionally, and nationally. But to maintain the momentum and ensure that activities are completed and integrated into the MAP strategies, continued and increased funding is required. The most successful elements will need to be carried forward into the next Integrated Strategic Plans (ISP), along with plans for expansion into other critical habitats is definitely needed especially in the south and in marine and coastal areas. USAID has made significant investments in biodiversity protection and natural resources conservation in Madagascar. It is a recognized leader as well as a trusted government advisor in the sector. The island nation's unique natural heritage certainly warrants continued funding for actions where the United States is already viewed as a key partner.

Other partners in the Alliance include NGOs that implement activities funded through Title II/PL 480, which are overseen by USAID and play important roles in regions where other Alliance members are active — Toamasina, Fianarantsoa, and Taolagnaro. A synopsis of these partners and their roles is found in Box 4.2.

Box 4.2 Food security program cooperating sponsors (Title II / PL 480)

CRS. The goal of the CRS FELANA program is to improve household food security of rural families in four targeted regions of Madagascar. In FY07, CRS is planning to reach 21,100 rural households through its agricultural activities. CRS will use Food For Work to build/rehabilitate dams and irrigation canals and will train 1,000 farmers in improved agricultural technologies and practices. CRS plans to increase farmers' revenue by US$105 in FY07 through a series of training sessions that links farmers to markets based on a farming systems approach. By improving agricultural infrastructures and techniques, the FELANA program contributes to improving farmer's food security and agricultural productivity that generates increased production and income, contributing to overall economic growth of the rural population.

ADRA. The goal of the ADRA TANTSAHA program is to increase household food security for 18,000 households (approximately 144,000 persons) in 25 communes of the Mangoro region in the Toamasina province. In FY07, ADRA is planning to reach 4,000 households through its agricultural activities. ADRA will use Food For Work to build/rehabilitate dams and irrigation canals and will train 976 model farmers, 2,258 co-trainers and 13,680 community members in improved agricultural technologies and practices as well as marketing techniques. ADRA plans to increase farmers' revenue in FY07 through training sessions in marketing and promotion of agricultural trades through fairs and direct contacts with potential buyers. By improving agricultural infrastructures and techniques, the TANTSAHA program contributes to better land and water management and improved food security and agricultural productivity that generate increased production and income for the rural population.

CARE. The overall goal of the CARE Food Security Program is to improve food security of targeted households in the rural east coast of Madagascar Toamasina, and poor households living in the capital city Antananarivo and the southern city in Taolagnaro. In FY07, CARE will train more than 637 model farmers in improved agricultural technologies and will use Food for Work to build/rehabilitate 34 small dams and 178 kilometers of irrigation canals that will result in 450 additional hectares of agricultural fields under improved technologies and management. CARE will also train 34 producers associations in marketing techniques and will facilitate 20 contracts between the associations and potential buyers. By improving agricultural infrastructures and techniques, the CARE Food Security program contributes to better land and water management and improved food security and agricultural productivity that generate increased production and income for the rural population.

4.4 Other Bi-lateral and Multi-lateral Initiatives

A number of other bi-lateral and multi-lateral donors are active in the environment sector in Madagascar. Several have had a long-term presence similar to USAID's. A summary of their portfolios is presented in the next section in Table 5.3. Several players are discussed here.

Millennium Challenge Account (MCA) Madagascar. Madagascar's MCA compact totals US$110 million throughout four years. The compact focuses on laying the groundwork, or creating an enabling environment for the country to promote economic growth and poverty reduction by transitioning from subsistence to market-oriented agriculture. This process entails national policy reform and program interventions in five target zones around the country. The MCAM program has three focus areas:

- Land tenure reform
- Financial sector reform
- Agricultural business development

The land tenure component focuses on both macro and micro level reforms. For example, it strives to modernize national land tenure administration at the central level while facilitating the acquisition of land certificates for small farmers at the community level.

The finance component also works on both levels. For example, it invests at the central level to streamline the national payments system while working at the regional level to increase the capacity of microfinance institutions to reach the rural poor.

The agriculture component is exclusively focused at the micro level. This component strives to link small producers to viable markets for their products, and through coordination with the other program components, to ensure that farmers also benefit from more secure land holdings and increased access to credit.

The program has been slow to show significant results in the regions and it may also be in serious jeopardy. The MCA is overseen by the Millennium Challenge Corporation (MCC). To remain operational and receive funding for the MCA the Malagasy government must meet and adhere to international established standards monitored by an independent auditor. During the last two audits Madagascar has failed to meet those associated with health and education. If it fails a third time, funding will be withdrawn. The MCA is a four-year program in the process of requesting a fifth-year extension.

GTZ-PGDRN. GTZ has been engaged with activities related to the development of Eaux et Forêts. Along with USAID it continues to be the most active donor directly involved with the MEEFT. It has projects in the north in the regions of Diana and Boeny, and in the south in Toliara — Androy, Ihorombe, Atsimo-Andrefana — primarily engaged in wood and charcoal supply issues. It intends to open a branch office in the southwest to focus on wood supplies and energy and will collaborate with WWF and other partners who are active in the region. GTZ has helped to develop and promote activities in watershed protection in conjunction with CIRAD. Most activities have protected rice paddy areas from sedimentation.

GTZ was a recent and major, contributor to the Biodiversity Trust Fund through KfW when € 7 million were deposited.

Pôles Intégrés de Croissance (PIC) or Integrated Poles of Growth. The PIC project is a World Bank-funded project to promote economic development on a large social scale within intervention zones. Activities include:

- Land management plan and infrastructures — roads, port improvements, and others
- Support to, and capacity building of, local communities
- Improvement of private enterprise framework that will stimulate new investment and human resources training

To date PIC has been active in Nosy Be in Diana region for tourism development, in the Antananarivo/Antsirabe axis for the NTIC, Free Zones for enterprises and food agri-business and in Taolagnaro in Anosy region for tourism and mining operation development.

4.5 Significant NGO Actions in the Sector

International and domestic NGOs have played active roles in accumulating knowledge, protecting, conserving, and managing Madagascar's biological resources for more than two decades. They have been and continue to be perennial contributors to promoting and developing the protected area system and defending critical terrestrial and marine habitats. Prior to and during the initial phases of EP1 and EP2, international NGOs such as Conservation International, World Wildlife Fund, and the Wildlife Conservation Society focused most of their efforts on researching and documenting Madagascar's unique biodiversity. They were and remain the most important defenders of this heritage and are the most responsible for raising global awareness of the island's endemism and obtaining the world's support to preserve and protect it.

Endemic flame tree in bloom in the Ranobe dry forest

Beginning about the time of the previous ETOA (2002) and continuing today, the approach of these international NGOs, joined by their domestic colleagues, has expanded to embrace greater rural development and local stakeholder engagement emphases. The Missouri Botanical Gardens, known almost exclusively for its strict focus on research, is finding a need at least in Madagascar to promote rural development and onsite conservation activities to help protect habitats that are the objectives of its more traditional inventory approaches. Local communities and the importance of rural livelihoods in and around protected areas are critical parts of most of these groups' activities. The Miaro project mentioned above in Section 4.2.2 engages three international NGOs in a rural development effort. Domestic NGOs such as SAGE, Fanamby, Tany Meva (Madagascar's first foundation) and the Biodiversity and Protected Areas Foundation are all substantial contributors who directly engage local communities in activities that include assisting with improved farming techniques, ecotourism, assisting with market linkages for agricultural crops, including coffee, vanilla, as well as niche and eco-friendly products unique to specific regions/sites.

These NGOs figure prominently in the MAP; they are viewed as critical players, especially in and around protected areas. The plan sees them as promoters and players in the development of co-management schemes for the new PAs coming on-line. NGOs have long been valued for the knowledge about Madagascar's biological assets they shared with the world. And now their roles are further enhanced by the government's leadership and the demand for them to play an even more responsible role in the future.

4.6 Private Sector Initiatives

Initiatives in the private sector are more difficult to catalog and to quantify. This section seeks to point out a couple of examples. The commercial mining sector has in 2007 substantially increased its activities in Madagascar, mainly in response to world market prices for nickel and iridium. In Ambatovy, in the Toamasina region, a vast swath of the primary humid forest has been removed as mining activities commence. The mining company Sherritt has engaged scientists in helping to monitor flora and fauna populations around the mine footprint, and to suggest alternative actions and strategies when it appears that actions will have negative impacts. WCS is also on-site as an independent monitor. Still, destructive activities are happening at a rapid rate and there remain many unknown effects associated with this type of activity in this unique environment. Sherritt operates a 4,000 ton-per-day limestone quarry in the Toliara region for use in the nickel processing plant being contracted in Toamasina.

Although EIAs were done for the mine site, the pipeline that feeds the processing plant and the plant's construction site, many "what ifs" remain unanswered. At the mine site contingencies for cyclone damage were based on an average storm. What if two cyclones hit the site successively in the same season? Could the plans in place mitigate the damage from these destructive storms especially given the newly exposed expanses in the middle of the humid forest? And at the processing site … what are the consequences of the air pollution that accompany the nickel processing? The prevailing winds will carry any pollutants westward, back across the island and directly into and across the humid forest. Have the consequences been thoroughly examined?

QMM's operations in the south are in an active start-up phase in a much more publicly visible site, but one that had already been significantly modified. It has invested considerable time and effort to develop contingencies, work with regional officials and local communities to mitigate its impact on local livelihoods and the environment — e.g., developing carbon offset plans, tree planting activities — and monitor flora and fauna populations and habitat conditions. Despite these activities the impact of large-scale unemployment at the completion of the construction phase does not appear to have been addressed adequately. This portends a major social issue and one that may have serious environmental impacts as well when the 2,000 temporary employees are released from their jobs. In a poor region such as Androy the boom and bust impacts of a large operation such as QMM's will have both positive and negative impacts that are much more pronounced.

There are still many unknowns related to these massive operations. The MAP is thoroughly dependent on them and they are an integral part of Madagascar's development. More will surely follow given the riches that lie beneath the surface of the territory. Petroleum exploratory permits, both terrestrial and marine, are being issued at an increased rate, along with those for other minerals. Fortunately, the large, and usually off-shore companies recognize the importance of sensitive and positive public relations, especially given the

awareness of Madagascar's biological richness that lies above what they are seeking to uncover. Most companies, to their credit, are engaging the government, donors, the NGO community and regional decision-makers in their negotiations. It appears that most of this is positive.

Artisanal mining is destructive to the environment and, although usually small and occurring in restricted areas, is no less devastating when taken as whole. The sociological impacts that can accompany both large and small-scale mining can also be negative as just mentioned above in reference to the QMM operation. Duffy (2007) describes in detail the shadier side illegal, small-scale mining in Madagascar, and points out the public health risks and the spread of HIV/AIDS linked to gem mining.

USAID has been an important advisor and member of the working group that seeks to restrict the damaging effects of unrestricted mining concession permitting. The current arrêté that prohibits concession activity until the new PAs are fully official is set to expire in October 2008. A new decree was published in March 2008 that halts the export of all mining products from Madagascar. The Mission needs to continue its efforts to make certain that the arrêté is extended. In fact, all stakeholders will need to continue to keep a watchful eye to protect Madagascar's biodiversity, its marine and coastal habitats and its tropical forests.

5.0 OPPORTUNITIES AND ENTRY POINTS FOR USAID

This section identifies opportunities and entry points for USAID/Madagascar efforts under the upcoming integrated strategic plan that will positively influence the conservation of tropical forests and biodiversity and improve environmental management.

Identification of the opportunities and entry points was achieved through the following steps:

a. Present results of the threats analysis in a single integrated table with responses and results to facilitate identification of linkages between resources (Table 5.1)
b. Analyze the legal requirements of the FAA
c. Take into account the activities of other donors *(*Table 5.2*)*
d. Take account of the views of environmental specialists in Madagascar *(*Table 5.3*)*
e. Discuss crosscutting themes
f. Make concluding recommendations on the opportunities and entry points *(*Table 5.4*)*

5.1 Threats Analysis

Table 5.1, which appears on the next several pages, represents an update of the 2002 ETOA. Four environmental resources are identified: forests and terrestrial biodiversity, freshwater systems and wetlands, marine and coastal ecosystems, and agricultural resources. Based on the 2002 ETOA and the 2008 ETOA team's analysis, the threats for each of the four resources are identified, the primary ones being listed first and in bold. For each threat, responses were formulated to address the threat. These responses serve as optimal results used later in the analysis to determine opportunities and entry points.

Note that this update includes many of the threats listed in the 2002 ETOA, and adds others as the situation demands. The Indicated Responses do not necessarily represent areas in which USAID is recommended to intervene, but rather are listed as general actions to be taken by any actor to address the corresponding threat.

Table 5.1 Biodiversity and tropical forest conservation threats analysis

Resource	Threats	Indicated Responses and Optimal Results
Forests and Terrestrial Biodiversity	1. Slash and burn agriculture (*tavy*)	1a. Promote Agricultural Intensification and Diversification in areas surrounding forests 1b. Promote Environmental Education 1c. Support maintenance and management of protected areas 1d. Promote economic growth in urban and rural areas away from protected areas
	2. Lack of Institutional Capacity	2a. Support capacity development of MEEFT employees and field agents in ecological monitoring, protected area management, policy reform and implementation, and sustainable financing 2b. Strengthen inter-ministerial cooperation 2c. Promote certification and adherence to international standards 2d. Support development of policy and management reform 2e. Promote NGO and donor coordination and collaboration to properly support institutions in sustainable manner, especially as related to new and existing protected areas

Resource	Threats	Indicated Responses and Optimal Results
Forests and Terrestrial Biodiversity (Cont.)	3. Increased Mining	3a. Strengthen inter and intra-ministerial cooperation 3b. Support development of ministry employees and field agents in protected area management 3c. Promote the enhancement and enforcement of mining laws, policies, and regulations (MECIE and EIAs) 3d. Promote private sector partnerships with mining companies to ensure holistic approaches to resource extraction and community involvement 3e. Support the timely elaboration of regional management plans and land use planning 3f. Ensure the extension of the mining Arreté 3g. Encourage and support community-based management systems 3h. Support maintenance and management of protected areas 3i. Support mining companies in implementing mitigation measures on social and environmental impacts in all phases of their operations especially where there are large numbers of temporary employees.
	4. Population Pressures	4a. Promote family planning 4b. Promote rural education 4c. Support urban development 4d. Promote behavioral change from traditional practices to holistic approaches 4e. Promote environmental education 4f. Promote agricultural intensification, diversification, commercialization, and accompanying market infrastructure 4g. Support maintenance and management of protected areas 4h. Promote the development of alternative livelihood pursuits, like ecotourism or other value-added activities for natural and cultural resources valorization
	5. Illegal or poorly regulated logging	5a. Support maintenance and management of protected areas 5b. Strengthen the development of forest product alternatives and sustainable extraction areas (tree plantations) 5c. Strengthen the enforcement of wood and timber product controls and laws 5d. Strengthen the capacity of forest authorities and institutions 5e. Encourage and support community-based management systems 5d. Encourage/develop private commercial forest plantations
	6. Annual burning of grasslands	6a. Promote environmental education 6b. Intensify cattle rearing 6c. Apply pastureland legislation
	g. Over-harvesting of endangered species	7a. Support maintenance and management of protected areas 7b. Support national CITES authority and strengthen chain of custody 7c. Strengthen forest authorities and institutions
	h. Climate change	8a. Promote environmental education 8b. Support maintenance and management of protected areas 8c. Plant trees
	i. Food Insecurity	9a. Promote agricultural intensification, diversification, commercialization, and accompanying market infrastructure 9b. Support maintenance and management of protected areas 9c. Support infrastructure development and maintenance

Resource	Threats	Indicated Responses and Optimal Results
Forests and Terrestrial Biodiversity (Cont.)	j. Over-harvesting of fuelwood / charcoal / timber	10a. Strengthen the development of forest product alternatives and sustainable extraction areas (tree plantations) 10b. Encourage and support community-based management systems 10c. "Professionalize" the charcoal sector 10d. Encourage the use of improved stoves 10e. Identify new sources of renewable energy 10f. Develop a politic of fuel wood tree-planting
	k. Lack of Land Tenure	11a. Support institutional reform and implementation of land laws 11b. Encourage and support community-based management systems
	l. Generational Land Division	12a. Encourage and support community-based management systems 12b. Promote agricultural intensification, diversification, commercialization, and accompanying market infrastructure
Freshwater Systems and Wetlands	1. Sedimentation from soil erosion due to deforestation	1a. Encourage nurseries and tree plantations 1b. Reduce forest loss (see above measures) 1c. Promote the rehabilitation of watersheds
	2. Over-harvesting of natural resources	2a. Encourage fish-farming, integrated farming, alternative product use (reeds) and other behavioral changes from traditional to holistic practices 2b. Support national CITES authority and strengthen chain of custody 2c. Strengthen inter and intra-ministerial cooperation 2d. Support capacity development of Fishery Ministry employees and field agents 2e. Support maintenance and management of protected areas 2f. Encourage and support community-based management systems
	3. Population Pressures	3a. See above
	4. Introduction of exotic species (plants and/or fish species)	4a. Promote environmental education on destructive species such as crayfish
	5. Climate change	5a. See above
	6. Institutional Capacity	6a. See above 6b. Promote integrated wetlands management plans at regional levels
	7. Pollution	7a. Promote environmental education including raising awareness about the effect of pollutants —— biological, chemical, physical and aesthetic 7b. Support communal infrastructure development 7c. Strengthen Institutional monitoring and enforcement capacity
	8. Lack of access to potable water	8a. Support communal infrastructure development 8b. Encourage more efficient irrigation and agricultural techniques

Resource	Threats	Indicated Responses and Optimal Results
Marine and Coastal Ecosystems	1. Destructive traditional fishing practices and degraded marine environment	1a. Encourage *Dispositif de Concentration de Poisson* ── DCP - artificial fishing concentration devices 1b. Develop laws and policies to address better enforcement and encourage environmentally friendly fishing practices 1c. Facilitate alternative and diversification of livelihood pursuits, incl. ecotourism 1d. Encourage the establishment of rotating marine reserves. 1e. Support maintenance and management of protected areas 1f. Encourage and support community-based management systems 1g. Promote marine research and encourage publication of results 1h. Help solve conflicts, particularly those regarding offshore oil exploration 1i. Encourage/facilitate formulation/enforcement of regulations related to protection of unique marine habitats
	2. Deforestation of Mangroves	2a. Encourage terrestrial and coastal Reforestation 2b. Develop laws and policies to address better protection of existing mangrove forests 2c. Develop and encourage alternative energy supplies
	3. Degraded Marine Environment	3a. Promote marine scientific research and encourage the publication of the results 3b. Help in solving conflicts of interests, particularly on offshore oil exploration 3c. Encourage and facilitate the formulation of regulations/laws related to environmental protection
	4. Climate change	4a. Promote marine environmental education 4b. Support maintenance and management of protected areas 4c. Plant trees 4d. Promote carbon sequestration and trading projects and initiatives 4e. Encourage the development and implementation of adaptation measures in cyclone vulnerable areas
	5. Population Pressures	5a. See Above
	6. Insufficiently regulated industrial fishing	6a. Promote the development and enforcement of stricter fishing laws and policies, especially related to long-line fishing. 6b. Support the development of institutional authority capacity related to enforcement, monitoring, and management 6c. Continue eco-labeling initiatives
	7. Continued Unregulated exploitation of high value resources (sea cucumbers and sharks' fins)	7a. Support the development of institutional authority capacity related to enforcement, monitoring, and management 7b. Promote behavioral change from traditional practices to holistic approaches 7d. Promote sea-cucumber farming as alternative mean to over-fishing 7c. Support national CITES authority and strengthen chain of custody
	8. Increased sedimentation of mangroves and coral reefs as a result of upland soil erosion	8a. Reduce forest loss (see above) 8b. Promote nurseries and tree plantations

Resource	Threats	Indicated Responses and Optimal Results
Marine and Coastal Ecosystems (Cont)	9. Introduction of exotic species	9a. Support environmental education on destructive species
	10. Pollution	10a. See above
	11. Institutional capacity/ regulation	11a. See above
	12. Oil Exploration	12a. Strengthen inter and intra-ministerial cooperation 12b. Support the development of institutional authority capacity related to enforcement and monitoring 12c. Promote the enhancement and enforcement of exploration laws, policies, and regulations (MECIE and EIAs)
Agricultural Resources	1. Weak market infrastructure / linkages	1a. Promote the development and maintenance of supporting trade infrastructure 1b. Support the development of communication links between/to communes and private operators 1c. Promote and support the identification of internal and external markets 1d. Promote secure land tenure 1e. Support the legal enforcement of contracts with buyers 1f. Promote fully integrated agricultural support to rural areas (including access to microcredit, agribusiness counseling, and
	2. Inefficient / traditional agricultural practices	2a. Support local behavioral change from traditional practices to holistic, efficient approaches 2b. Promote agricultural intensification and diversification 2c. Support the implementation of a certification process for a better and more standardized agricultural or agri-business product
	3. Population Pressures	3a. See above
	4. Soil erosion	4a. See above
	5. Decline in soil fertility	5a. Promote agricultural diversification and improvement 5b. Support local behavioral change from traditional practices to more efficient and complementary approaches
	6. Lack of disposable cash	6a. Promote the development of alternative livelihood pursuits, like ecotourism 6b. Promote Agricultural Intensification and Diversification 6c. Strengthen market infrastructure / linkages (see above)
	7. Insecure land tenure	7a. Support the revision and implementation of land tenure laws and policies at national, regional, and communal levels 7b. Encourage and support community-based management systems
	8. Exotic and invasive species (raketa, boars)	8a. Promote Environmental Education 8b. Encourage and support community-based management systems 8c. Raketa: stop the invasion by biological means; Boar: encourage local consumption and market to reduce the population size of the species
	9. Drought	9a. Promote the development and maintenance of supporting trade infrastructure 9b. Encourage the development and implementation of adaptation measures in drought vulnerable areas (dune stabilization, more efficient irrigation practices)
	10. Climate change	10a. See above

5.2 Analysis of Legal Requirements under the FAA

The Foreign Assistance Act represents primary guidelines provided for the U.S. government to determine its international development strategy and policy. It is imperative to follow these directives when formulating strategy for USAID. Sections 117, 118, and 119 address environmental, forest, and biodiversity conservation, and the priorities that projects should consider when taking action.

Section 117 of the Foreign Assistance Act of 1961, as amended, points out that environmental degradation threatens to undermine "efforts to meet basic human needs, sustained economic growth, and to prevent international tension and conflict." It is therefore in the economic and security interest of the United States to: 1) provide leadership in re-assessing natural resource policies, and, 2) collaborate with developing countries to achieve environmentally sound development. In particular, programs should be subjected to an environmental assessment process.

Section 118 notes the importance of tropical forests and tree cover to developing countries and that forest loss causes *inter alia* loss of productive wetlands, siltation of lakes, extinction of plant and animal species, reduced capacity for food production, loss of genetic resources and can result in desertification and destabilization of the earth's climate.

Accordingly, in giving assistance, the president has to place high priority on "conservation and management of tropical forests," and such assistance should prioritize projects that "offer employment and income alternatives to those who otherwise would cause destruction and loss of forests," and which "help developing countries identify and implement alternatives to colonizing forested areas."

Other priorities emphasized in Section 118 (c), 4 – 11 are:

- Support to training programs, educational efforts and institutional strengthening which increase the capacity of developing countries to formulate forest policies, engage in land-use planning and improve forest management
- Help end slash and burn cultivation by supporting stable farming practices
- Help conserve forests that have not yet been degraded by helping to increase production on cleared or degraded lands through support of reforestation, fuel wood, and other sustainable forestry projects
- Support projects to conserve forest watersheds and rehabilitate those that have been deforested
- Support training, research, and other actions that lead to more environmentally sound practices of forest use, reforestation, soil conservation, and activities to rehabilitate degraded forest lands
- Support research to expand knowledge of tropical forests and identify alternatives to their destructive use
- Help developing countries identify tropical forest ecosystems and species in need of conservation, establish and maintain protected areas, make the establishment of protected areas a condition for support of activities
- Increase the awareness of the U.S. government, other agencies, and donors of the immediate and long-term value of tropical forests.

With particular regard to the present ETOA, each country plan prepared by USAID should include an analysis of:

1. The actions necessary in that country to achieve conservation and sustainable management of tropical forests
2. The extent to which the actions proposed for support…meet the needs identified (s. 118, FAA)

Therefore, the explicit purpose of this Environmental Threats and Opportunities Assessment is to facilitate the preparation of such an analysis. And, as part of this document (see Annex B), an Environmental Analysis of Madagascar, 2008, has been prepared to meet the requirements of the FAA's Sections 118 and 119.

To respect the orientation and priorities of the above legal requirements this ETOA has:

- Given priority to an assessment of the status and causes of degradation and loss of tropical forests
- Given consideration to key resources whose status and development is causally linked to the degradation of tropical forests, as well as marine and freshwater resources and agricultural resources
- In identifying opportunities and entry points for USAID, given full consideration of the orientations and priorities identified in Sections 117-119 of the Foreign Assistance Act

For opportunities and entry points for USAID, consideration has been given to those that:

- Involve an element of leadership from the U.S. or U.S. institutions
- Are cooperative in nature
- Prioritize conservation and management of tropical forests
- Offer employment and income alternatives to those who otherwise would cause destruction and loss of forests
- Help identify and implement alternatives to colonizing forested areas
- Observe the priorities of Section 118 (c) (4)-(11) noted above

5.3 Summary of Interventions by Other Major Donors

Because Madagascar is categorized as a "biodiversity hotspot," it attracts intervention by international donors in the field of conservation. It also attracts donors in standard development projects such as infrastructure, health, and private sector development. Table 5.2 summarizes the actions and projects and principal areas of intervention by the major donors in Madagascar.

Cooperation and collaboration between donors is a highly desirable end result when possible. This table is designed as a reference to facilitate cooperative and collaborative efforts in implementation but also information and methodology sharing.

Table 5.2 Summary of interventions by major donors

Donor	Principal areas of investment
World Bank	By sector: infrastructure (30%); human development (27%); private sector development (22%); agriculture and environment (17%); public administration (4%). By project (in IBRD/IDA US$ millions): Transport Infrastructure Investment (US$150), Integrated Growth Poles (US$129.8), Community Development Fund (US$110), Rural Development Support (US$89.05), Rural Transport (US$80), Community Development Fund Supplemental Credit (US$50), PE3 Support (US$40), Mineral Resources Governance (US$32), Second Multisectoral STI/HIV/AIDS Prevention (US$30), Governance and Institutional Development (US$30), Irrigation and Watershed Management (US$30), Second Community Nutrition (US$27.6), MG – Private Sector Development II (US$23.8), MG – Community Development Fund (US$18), Microfinance (US$16.4), Transport Infrastructure additional funding (US$15.6), Second Community Nutrition additional funding (US$10), Power/Water Sectors Recovery and Restructuring (US$10), Madagascar Sustainable Health System Development (US$10), Madagascar – Nutrition II (US$10), Mineral Resources Governance additional funding (US$8), Governance and Institutional Development – M&E supplement (US$5), Madagascar Microfinance supplemental (US$5), Public Sector Adj (US$1.7), Public Sector Adj (US$1.4), Public Sector Adj (US$1.4), Public Sector Adj (US$1.3), Public Sector Adj (US$1.2), Mainstreaming Climate Change and Disaster Risk Management into Economic Development (US$0), PE3 Support (US$0)
France	French cooperation: education, health, infrastructure and energy, rural development and the environment, macroeconomic support, governance, decentralization, transport sector support, private sector support, water, culture. AFD Projects (in millions €): ex FSP Health Support Plan (1,106), ex FSP Larger Tana Development (774.66), Education Program (683), PADR Support (188.41), Budget Support (22.84), Watershed Protection and Production (21.64), Antsiranana Port Rehabilitation (15), Mahajanga Market Rehabilitation (9.86), JIRAMA Recovery (9.4), Primary School Construction and Rehabilitation (8.5), Morondova Port Rehabilitation (6.75), Crisis Exit Guarantee Fonds (4.86),Shrimp Production Support (2.26), South Microfinance (1.36), Rural Development (1.5), Success School (1.06)
EU	9th European Development Fund (EDF) – Transport (186 M€), Macroeconomic Support (145 M€), Rural Development and Food Security Support (65.75 M€), Good Governance (21.74 M€)
US	Support to environmental sector: biodiversity, environmental management. Health family planning, with accent on institutional capacity building. Poverty reduction mainly through improved participation of poor in development Food aid mini-projects in agriculture, health and education Emergency relief after cyclones
IMF	Policy advice and reforms related to 1) macroeconomic policies and targets, 2) tax policy and administration, 3) budgetary accounting, 4) treasury procedures, 5) public sector wage policy, 6) monetary management and exchange rate policy
GTZ / PGDRN	Environmental and forestry policy; communal and regional resource management support (Androy, Ihorombe); rational energy and resource management (north); environmental education Projects primarily focused in the north, with some activity in the Tulear region. A new GTZ branch (office) will open in the southwest with a program focus on wood and energy, collaborating with WWF and other partners
Japan	ODA Projects (100 millions ¥): Antsirabe Agricultural Formation Center Support (5.78), Tana Access Road Construction (.33) Japan International Cooperation Agency (JICA) Grants (100 millions ¥): Primary School Support in Antsiranana and Toliara (10.32), National Route 7 Bypass (3.79). JIPA Technical Cooperation: improvement of maternal, newborn, and child health services, Mahjunga University Hospital improvement, fisheries
UNICEF	Health public, maternal and infantile and nutrition (mainly iodine deficiency; education, mainly primary; Water and sanitation infrastructure, behavior change, legal framework; children poorest families; disaster relief; planning and social statistics: communication, monitoring
UNDP	Programs (US$10.611 million, 2008): poverty reduction – literacy, microfinance, private sector development, environmental protection (community conservation of Anjozorobe-Angavo corridor, US$1.175 million (primarily GEF); governance – human rights, reform of public administration, decentralization support, parliament support, land law; health – HIV/AIDS

5.4 Recommendations of Environmental Specialists

The 2008 ETOA team spoke with a variety of actors and stakeholders throughout the country. These specialists and beneficiaries possess a wealth of institutional memory concerning past and current projects. They have seen first-hand the ramifications of the changes presented above since the 2002 ETOA. They have directly participated and implemented the current

and past initiatives of USAID and other donors. The informed views of these professionals and stakeholders is summarized in Table 5.3**.**

Table 5.3 Recommendations and observations of specialists consulted

Theme	Recommendations
Situation of forests	• Forest is seen as last reserve for many people, where they turn to get resources when times get tough • There has been a decrease in *tavy* in intervention areas, but overall rate and practices remains unchanged and a real threat to forest conservation; it *does* appear that agricultural intensification and diversification still remain to be the best solutions • Complementing economic corridors are key to protecting forest corridors • Illegal logging remains a major and ongoing threat • There is a strong link between the access to forests resources and other sectors (non-access to one causes increased access to the other and vice-versa. Examples are forest/marine resources; forest/mining resources or value-added activities such as vanilla and coffee culture) • A major national tree planting initiative
Situation of coastal/marine areas	• Mangroves are of utmost importance to marine and coastal ecosystems conservation • Mangrove deforestation rates are increasing with adverse affects on coastal and marine ecosystems, so issues to protect them should be a priority • Although marine and coastal areas were identified as priority in PE3, not many organizations intervene there. Expertise is needed in this domain to better manage the corresponding areas, especially those subject to mining or large fishery operations • Significant portion (1 million ha expected) of new PAs will be marine, and support from international community needs adjusting in that direction
Government of Madagascar	• Government needs to take lead in coordinating CBNRM approaches • Democratic process has led to breakdown of state enforcement due to a constant electoral process causing an increase in deforestation rates • Many government ministries and employees lack proper training to perform newly assigned duties, especially in MEEFT relating to new PAs • Strong government complemented by quick and supportive judicial system is required to address food insecurity of communities outlying corridor • MEEFT needs to take lead in coordinating and directing collaboration of international and domestic NGOs, institutions, and other actors • Instability of government, especially in MEEFT, makes it weak
MAP / NEAP / EP3	• MAP is very well publicized • MAP is the new, integrated, national vision, replacing the NEAP/EP3 • EP3 has been weakest of three EP phases • USAID has switched focus from EP3 to MAP, but WB is slower to react
Durban Vision	• Biodiversity Trust Fund needs more funding to ensure a sustainable financial mechanism for its intended activities • Has spurred a land grab in sites where settlers anticipate compensation for future protected area designation
Decentralization	• If regions can get resources and become empowered this could have positive influence • Donors can empower regional governments instead of going over their heads • *Chef de régions* are more empowered than governors, but could lead to challenges if they are changed too often • Division of provinces has pushed certain PAs and corridors to periphery of regional politics (Fianarantsoa)

Theme	Recommendations
Community management	• Traditional conservation NGOs need to focus more attention on agricultural intensification • Many communes are difficult to reach • GELOSE tried to do too much too fast • Local acknowledgement that corridor is water tower of regions and directly affects harvest cycles and water regulation is spreading • Communities are starting to take initiative and responsibility • Rural areas and communities must be implicated in SIMPLE plans and structures • Communities cannot think of the future and, despite knowledge of consequences, are forced to pursue destructive practices in the present • Management by local communities alone was not effective
Inter-organizational cooperation	• USAID has been leader in facilitating coordination between the government, donors, stakeholders, and interveners • Coordination carries weight with authorities, but the more difficult task lies in harmonizing field synergies • Sometimes USAID and governments are in competition (LDI and ONE in corridor) • Information sharing of CBNRM practices is needed • Organizations need to play by the same rules of the game • Competing donors and axes of interventions lead the government to select the one who offers more funding
Private sector	• Prior to the MAP the private sector has never been strategically integrated into the process of sustainable development of natural resources • Reinforcing environmental awareness and education in private sector development is a very positive step that needs encouraging • Accompanying measures regarding EIAs, or any other environmental rules, should be improved and proposed to private sector • Efforts to support valuation initiatives — sustainable tourism / ecotourism, education, certification — need to be reinforced
Role of USAID	• USAID and its partners are seen as leaders in environmental development and conservation • USAID needs to focus more on infrastructure such as rural roads, irrigation, access to drinking water • USAID needs to focus where its strengths are — entrepreneurial, agricultural production, carbon sequestration, trade on bio-products, policy initiatives • USAID projects address those who have land, but ignores those who do not • USAID integrated projects, like ERI or LDI, have been successful, should be continued, and expanded to the south, where environmental threats and risks are very high • While USAID should not prematurely end its projects in the forest corridor, it has been greatly focused in this area to the detriment of other areas • Past USAID interventions filled gaps, but lacked comprehensive vision

5.5 Crosscutting Themes

There are many areas that can be incorporated into integrated environmental conservation that are not unique to its domain. These crosscutting themes are implemented across sectors by many donors. While environmental projects might not directly intervene in these areas, it is important to encourage, promote and coordinate with other donors and sectors to incorporate conservation themes into their programs. Similarly conservation and biodiversity programs should not ignore these themes when designing their projects.

5.5.1 Gender

Gender issues are prevalent throughout all sectors of development. Women often represent the primary manager of households, procuring quotidian goods, responsible for many daily tasks. Many microfinance programs and projects focus on women as target recipients to empower them, providing opportunities in markets that otherwise would not exist —

vegetable cooperatives, arts and crafts, entrepreneurial enterprises, education centers. Health programs are often tightly focused on the role that gender plays in the household, from family planning and reproductive health, to immunization campaigns and sanitation. Environmental subject matter should be incorporated into these programs. Microcredit could include EIAs for larger projects, health programs should incorporate environmental education waste disposal. Child nutrition programs can encourage and complement agricultural diversification.

Conservation and biodiversity programs, especially as they expand into integrated development projects, must incorporate gender themes at all levels. Levels of inclusiveness should be examined to ensure equal opportunity despite traditional structures. Revisions of land laws should be considered to promote gender equality when possible.

5.5.2 Education

Education touches the young and the old. Primary and secondary schools should incorporate environmental education into their programs. Students should be educated about the value of biodiversity and forests, the linkages between ecosystems, the uniqueness of Madagascar's flora and fauna, and the destructive practices that threaten them all. The MAP does highlight education as one of its eight commitments but the role of the environment and indicators to track its importance could be given a greater and more strategic priority. Literate beneficiaries are more likely to be exposed to educational materials concerning the environment and be open to new ideas, understanding foreign concepts.

Education is important as a benefit for professional staff to work in the regional posts. Qualified technicians are more likely to serve in cities and towns outside of Antananarivo and regional capitals if the support system for their families exists there. This is also true for health services. The shortage of qualified ministry professionals is compounded by the fact that few can be enticed to work in the field where conservation implementation takes place.

5.5.3 Behavioral Change

Anthropological practices are integral to development. Behavioral change cannot be forced or encouraged through inappropriate means. Many traditional practices, from agriculture to fishing, are destructive to ecosystems. Cultivation techniques, construction methods, and cooking practices can contribute to erosion, species endangerment, and increased pressures on the forest. Economic growth and wealth creation, if not complemented with behavioral change, can greatly compound threats. A farmer that increases his income from crop intensification and diversification will readily invest in more land for his prodigy, directly threatening the bordering forest.

Behavior change should be examined across sectors to share information and experiences. Despite technical differences, basic principles and approaches are common when working with cultures and regions. Coordination of community management of protected areas with community approaches to health, education, and finance provides a succinct example of how coordination methodology can benefit different donors and communities.

5.5.4 Climate Change

Global warming is traditionally thought of as an environmental theme; however it is becoming increasingly accepted as an issue that affects all fields of development, and will affect all peoples of the world. The conservation focus of Madagascar presents a unique opportunity to promote the incorporation of climate change and global warming themes across sectors. The high profile of cyclone destruction, the rise of sea levels and temperatures, increased vulnerability of coral reefs and forests, the prolonged droughts and increased weather variation can all be linked to climate change.

It falls to conservation organizations as traditional actors in climate change to promote the incorporation of climate change themes, adaptation strategies, and environmental education across all sectors and within programs and projects of all donors.

5.6 Recommended Opportunities and Entry Points

As presented in Section 5, this 2008 update of the 2002 ETOA identified threats to environmental resources. Next, the requirements of the U.S. government's Foreign Assistance Act, interventions of other donors, recommendations of environmental experts and crosscutting themes were taken into account. Thus identification of the opportunities and entry points was achieved through the following steps:

1. A presentation of the results of the threats analysis in a single integrated table with corresponding indicated responses and optimal results to facilitate identification of linkages between resources (Table 5.1)
2. An analysis the legal requirements of the FAA
3. An accounting of the activities of other donors
4. A summary of the views of environmental specialists in Madagascar (Table 5.3)
5. A discussion of crosscutting themes

General entry points were first formulated to accompany each optimal result. These entry points represent opportunities and actions upon which a project could endeavor to achieve the optimal result and address the threat presented in Table 5.1. It should be noted that many optimal results address several identified threats across different environmental resources. The optimal results and entry points were then analyzed given the information presented in this 2008 ETOA update as well as the 2002 ETOA. The final outcome is presented in Table 5.4 that lists the priority optimal results, their corresponding recommended entry points for USAID, and a brief analysis of the result area.

Table 5.4 Priority optimal results areas and recommended entry points

Optimal Result Area	Recommended Entry Points	Analysis
1. Promote agricultural intensification, diversification, commercialization, and accompanying market infrastructure	• Promote agricultural intensification and diversification initiatives around forest corridors, dry and spiny forests, and coastal mangrove forests • Promote adequate monitoring of impacts on soil, forest conservation, and biodiversity • Promote technology transfer from U.S. institutions • Ensure the integration of agricultural intensification and diversification initiatives and monitoring into regional development plans, including the rural development plans • Encourage community agricultural organization • Support the improvement of access of rural communities to micro-credit • Promote inter-commune and inter-regional communications on trade • Develop partnerships with donors and the regions institutions in rehabilitating agricultural infrastructures in potential zones (corridors where there are Koloharena) • Help communities identify markets, find buyers, and with negotiation and computation skills	• USAID has project experience in this area • FAA priority • USAID Strength • Other donors present
2. Support maintenance and management of protected areas	• Support government in developing sustainable finance mechanisms and strategies • Promote capacity building of managing authorities, especially in monitoring, enforcement, and management • Encourage the creation and designation of new protected areas based on collaborative management, and in some cases include community management responsibilities • Promote focus on marine and coastal protected areas among donors and institutions • Elaborate technical guidelines relative to the new PA creation (procedures, management, monitoring, valorization) • Promote inter-ministry cooperation and collaboration, already mandated by the government • Promote the strengthening of national CITES authority • Discuss and find a balance with other sectors particularly the mining industry superposing with the future PAs	• USAID has project experience in this area • FAA priority • Other donors present
3. Support capacity development of MEEFT employees and field agents	• Encourage cooperation and collaboration between ministries (MEEFT, Fisheries, Mining) • Encourage cooperation and collaboration within MEEFT and other institutions (ANGAP, SAPM, ONE) • Promote capacity building of regional agents in monitoring, enforcement, and management • Promote regional infrastructure development to support regional agents • Promote communication and information linkages between national and regional offices • Promote the incorporation of international standards and regulations into national and regional law and policy	• USAID has project experience in this area • FAA priority • Other donors present
4. Strengthen inter and intra-Ministerial cooperation	• Support the definition of roles and responsibilities within and between ministries • Promote the regional implementation of the MAP • Promote the strengthening of communication and information sharing development within and between ministry offices	• USAID has project experience in this area

Optimal Result Area	Recommended Entry Points	Analysis
5. Encourage and support community-based management systems	• Promote community organization • Promote land tenure security • Promote the timely elaboration of regional and communal grassroots land-use planning and zoning • Promote capacity building of communities surrounding protected areas regarding resources management and valorization • Promote the defining of IUCN protected area categories 5,6 in a national context • Encourage the dissemination of technical information through community channels • Support the regional authorities in establishing relations with their communes • Take advantage of the newly established Community Support Centers	• USAID has project experience in this area • USAID strength • Other donors present
6. Develop laws and policies to address better enforcement and encourage environmentally resource use	• Support MEEFT in capacity building • Encourage the adoption of international standards in national environmental policy • Promote and support the drafting and passing of environmental standards, laws, regulations, and policies in different main sectors (mining, tourism, energy, industry and trade, fisheries, agriculture) • Promote the dissemination of laws and policies throughout the country's population • Ensure the implementation of international conventions • Encourage the implementation of laws and policies at regional and local levels	• USAID has project experience in this area • United States has expertise in this area
7. Promote the enhancement and enforcement of resource exploration and extraction laws, policies, and regulations (MECIE and EIAs)	• Facilitate the elaboration and dissemination of a comprehensive and clear government policy regarding resource exploitation • Promote the strengthening of inter-ministerial communication, cooperation, and collaboration • Support the continual refinement of forest zoning process and procedure • Encourage the adoption of international environmental standards and practices at national and regional levels • Provide for capacity building of monitoring and enforcement authorities	• USAID has project experience in this area
8. Promote carbon sequestration and trading projects and initiatives	• Facilitate the communication between carbon investors and the government • Promote the expansion of carbon sequestration sites • Support the development of pilot carbon sequestration sites • Encourage the incorporation of carbon trading and CDM projects into the national and regional agendas.	• United States has expertise in this area • Other donors present
9. Support national CITES authority and strengthen chain of custody	• Promote the transfer of expertise from U.S. institutions • Promote the strengthening of communication between regional authorities and ministries • Support the capacity building of regional and national institutions on monitoring and enforcement • Reinforce the control of import/export species by creating a neutral private office (similar to Bureau Veritas)	• United States has expertise in this area

Optimal Result Area	Recommended Entry Points	Analysis
10. Promote the development of alternative livelihood pursuits, like ecotourism	• Support the development of specialty rural markets (organic, essential oils, artisanal) • Promote the development of fair trade linkages with U.S. and other international markets • Reinforce the implementation of a coherent national sustainable tourism/ecotourism strategy and corresponding policies both in national and in regional levels • Support the review of the EIA Law (MECIE) regarding tourism activities • Promote the development of middle class luxury eco-tourism • Promote foreign and domestic private sector investment in rural areas • Support the improvement of access of rural communities to micro-credit • Support the implementation of sustainable tourism/ecotourism labels • Reinforce the public awareness and education regarding sustainable tourism / ecotourism principles and labels	• USAID has project experience in this area • FAA priority • Other donors present
11. Support the revision and implementation of land tenure laws and policies at national, regional, and communal levels	• Support the revision and continual evaluation of land laws and codes • Promote the timely elaboration of regional land-use plans • Promote the strengthening of inter-ministerial communication, cooperation, and collaboration as it relates to land zoning, national priorities, protected areas, and communal involvement	• USAID has project experience in this area • Other donors present
12. Encourage nurseries and tree plantations	• Promote community investment in tree nurseries and plantations • Support incentive programs that encourage community distinction between plantation and non-plantation charcoal • Encourage the designation of reforestation sites • Support the Koloala and sustainable forest management sites	• USAID has project experience in this area • United States has expertise in this area • Other donors present
13. Support the timely elaboration of regional development plans (PRDs) and land-use planning	• Support the capacity building of regional authorities and agents • Promote the prompt and proper dissemination of information from national to regional levels • Promote the development of national incentive structures for regional achievements • Facilitate the uniformity and continuity of monitoring and indicator reporting	• Other donors present
14. Promote family planning	• Promote the use of birth control and family planning • Promote the dissemination of family planning information through television, radio, and billboard campaigns • Facilitate the supply of local health centers with appropriate technical materials and literature • Support the capacity building of health agents • Promote the program and project coordination of international organizations	• USAID has project experience in this area • Other donors present
15. Support infrastructure development and maintenance	• Promote the development of transport infrastructure to facilitate domestic trade routes • Encourage FDI in areas of international trade and vertical integration of domestic industry • Promote the proliferation of reliable telecommunication systems to rural towns	• United States has expertise in this area • Other donors present
16. Promote environmental education	• Promote the education at primary and secondary levels on the value of forest, freshwater and marine ecosystems, and biodiversity, and how appropriate natural resource management can sustain social and economic stability • Promote the education at primary and secondary levels of the affects of climate change • Promote the proper valorization of biodiversity and the environment	• Not USAID strength • Other donors present

6.0 CONCLUSION

The recommendations and entry points presented in the previous section are a synthesis of the interviews, research, and discussions that are all part of the 2008 ETOA Updating exercise. During the course of the assessment the ETOA team gained a fairly comprehensive overview of current and past activities as well as future plans for action focused on Madagascar's biodiversity, marine and coastal resources, and its tropical forests. As noted throughout this report, a number of points stood out.

Transporting charcoal to Ft. Dauphin

First, USAID has extensive experience in environmental conservation and integrated rural development in Madagascar. Working with government, international donors, NGOs, and private sector partners has been successful in building on the lessons it has learned from successive iterations of the technical assistance it has helped to finance and implement. The current Environment and Rural Development Program (SO6) contracts of MIARO, Jariala, and ERI are both witness to those past experiences and a testimony to strategies that help ensure success. Consequently, as the ETOA team heard throughout the assessment, USAID is a recognized leader in Madagascar's environmental community, one of the important tenets strived for under the FAA.

Second, USAID's funding for current SO6 contracts ends in FY 2008. Even with a planned extension, it is unlikely that many of the ongoing activities will achieve the desired state of "sustainability" and completeness. And although this 2008 ETOA update emphasized a strong need for USAID to expand its areas of intervention to include marine, coastal, and dry forest areas, it is equally, if not more important, to maintain support of current projects until they have reached critical points of sustainability. In the forest corridors, this translates to continued support and monitoring of community management projects (ERI) and protected area administration (MIARO). At the ministry level, this involves continually strengthening the capacity of officials and policy makers, while seeing through current Jariala efforts to their conclusion. Funding of USAID-financed programs for environmental activities in Madagascar is money well spent, but it is not sufficient for the role USAID is filling. More is needed and past experience with its current leadership position can help ensure that it will be a wise investment.

Another important and positive element has been the introduction of the Madagascar Action Plan onto the national stage. It has served to reestablish the leadership of the Government of Madagascar in the development arena. It is well timed, bold, and builds on the positive experiences of its own past efforts as well as those lessons learned from donors and the private sector. Although it is an overarching plan for development, it is holistic in its approach and the attention it pays to the environment and environmental issues is front and center. Even with all the recent shuffling within MEEFT, the MAP should transcend the

politics and be relied upon for its guiding strategy and targeted activities to develop the Malagasy economy and improve the livelihoods of the Malagasy people. It certainly can be used as a guide, not just for the Government of Madagascar, but also for donors and NGOs as they strive for long-term sustainable and beneficial conservation and development.

The MAP also builds substantially on USAID's rural development experiences and successes of the past several years, using an integrated landscape approach as a more complete way to undertake conservation. This can also be expanded. Agricultural development needs to be supported by economic and communication infrastructure. These components facilitate and support the transition to alternative livelihoods and encourage the establishment of agricultural diversification through increased trade.

Clear indicators still need to be defined in some areas; and effective monitoring and evaluation needs to be executed, but the MAP offers a unique opportunity for the donor community and USAID to collaborate with the Malagasy government. This opportunity represents a chance to coordinate program and project goals between donors and the government, as well as within the Malagasy government itself. More importantly, capacity strengthening should be pursued alongside the development and execution of the MAP at a national and regional level to ensure its sustainability and effectiveness.

Despite the MAP's boldness, it is not enough, at least in the early stages to compensate for the concerns about the capacity of the MEEFT to handle new responsibilities and added administration – a worry heard repeatedly by the ETOA team from NGOs, donors, and even MEEFT officials. The recent high turnover rate in ANGAP highlighted training needs in upper echelons and among regional agents. The large expansion of protected areas under the Durban Vision will place considerable strain on MEEFT to create, manage, and monitor ecosystems, actions where is does not have experience. The capacity of MEEFT needs to be strengthened from policy development to ecological monitoring; this is an immediate need that warrants attention and assistance from USAID and others. The failure to address this issue will almost surely result in paper parks, ineffective, incoherent and uncoordinated policy, and continued and increased degradation of the environment of Madagascar.

Coupled with this crisis is the perennial issue of funding protected areas and other conservation activities. Sustainable financing is being addressed by GTZ and other EU donors, but there needs to be substantially more.

The government's push to increase foreign direct investment though mining — and soon, more overt petroleum exploration — is a huge challenge in the face of maintaining and protecting Madagascar's unique natural environment. The MAP lays out ambitious targets, that if not managed properly, could have disastrous consequences. The large mining operations that the ETOA team toured, the Sherritt and QMM sites, had very different situations due to the nature and locations of the extractions, timeline constraints, proximity to communities, and resources available to the companies. Both are making concerted efforts to minimize their impact, and fortunately both are sensitive to public and world opinion about their operations, especially with Madagascar's renowned biological heritage. But many unforeseen consequences could present significant challenges in the form of erosion, cyclones, and social impacts. It is imperative that the Malagasy government, USAID, and other donors maintain a dialogue with private mining interests to ensure proper construction and operation, and collaborate and/or coordinate to minimize environmental impact and maximize offsets and environmental precautions.

There have been significant changes in Madagascar since the 2002 ETOA that have, or will have, direct impact on its biodiversity, its coastal and marine resources, and its tropical forests. Most of the political changes have been positive ones and the government, donors, and other environmental stakeholders are working more closely today than ever before. Malagasy livelihoods, particularly those that depend on the forests, the oceans, and the soil are also increasingly at risk due mainly to human-induced threats to the natural resources. USAID has been, and continues to be, a leader in helping to address these threats. Hopefully this assessment will help to re-emphasize the key environmental issues and to help establish priorities and address them in the next planning cycle.

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ANNEX A

Scope of Work

Updated Environmental Threats and Opportunities Assessment
USAID/Madagascar

I. Purpose and Objective

The purpose of this task order is to update the Environmental Threats and Opportunities Assessment (ETOA) conducted in February and March 2002. The ETOA describes the status of actions necessary to conserve biodiversity and tropical forests in Madagascar.

This assessment will examine (1) the state of biodiversity and forest conservation in Madagascar, (2) the actions necessary to conserve tropical forests and biological diversity, and (3) the extent to which the actions proposed for support by USAID/Madagascar meet or could meet the needs thus identified. This assessment is intended to serve as a planning tool to assist USAID/Madagascar in better integrating environmental concerns into their existing and proposed programs in the short and medium term. The assessment is also necessary for complying with sections 118 and 119 of the Foreign Assistance Act of 1961, as amended, as well as critical to informing operational plans and the country assistance strategy.

The 2008 assessment will be carried out by a team of three international short-term consultants experienced in USAID strategic planning and a sound knowledge of USAID's environmental policies and procedures, legislation and requirements as governed by the Foreign Assistance Act (FAA). The team will also include the Mission Environmental Officer (MEO), Josoa Razafindretsa and one to two Malagasy consultants. Lisa Gaylord, the environmental and rural team leader for USAID/Madagascar will have an advisory role.

II. Background — Malagasy Environmental Profiles

Located off the coast of southeastern Africa, the island of Madagascar is divided into 18 provinces bordered on the west by the Indian Ocean and on the east by the Pacific Ocean. Madagascar has been identified by the international community as a megadiversity hotspot. It qualifies for this status because of a combination of factors, including its high levels of diversity, endemism, and degree of threat. Madagascar's flora accounts for about 12,000 species, of which approximately 10,000 are forest dependent. Most of the remaining native flora is forest associated; 81 percent to 86 percent of those are endemic. A substantial proportion (33 percent) of the native flora consists of trees or shrubs, of which 96 percent are endemic. Madagascar alone harbors more orchid species than does the whole of Africa.

As stated in the 2002 ETOA Malagasy forests comprise 4,220 known species of trees and large shrubs. An analysis of the tree flora reveals that 33 percent of the 490 indigenous genera with tree species are endemic to Madagascar. The 329 non-endemic genera are represented by an additional 3,280 species of trees and large shrubs, of which 95 percent are endemic (Schatz in Lourenço and Goodman, 2000).

At the time of the 2002 ETOA, assessments of changes in Madagascar's forest cover have estimated that forest loss was occurring at an average rate of 1.5 percent to 3 percent per annum. In 2002, the remaining 13,463,000 hectares of forests (primary and degraded)

accounted for 23 percent of the island's total area (J. M. Dufils, 2001 in Stiassny, M. & Sparks, J.,) and harbored the overwhelming majority of Madagascar's endemic species.

Forests in Madagascar are perceived as a source of goods such as fuel, building material, and medicine. Local people's livelihoods heavily depend on forest resources. According to the 2002 ETOA, in 1998, it was estimated that 96 percent of collected forest products in Madagascar consisted of wood for household consumption, especially in the form of charcoal. Most importantly, Malagasy people regard forests as a means to acquire land for the expansion of agricultural production. They usually acquire that land through slash and burn agricultural (a process call *tavy* in the Malagasy language). At the national level, forest resources are considered a source of foreign currency and energy: Per the 2002 ETOA, 75 percent of forest export revenues in Madagascar were generated through the export of timber.

In sum, tropical forests and biodiversity are closely entwined. Forests are a sub-component of the varied ecosystems and species that contribute to the rich and threatened biodiversity of Madagascar. Issues and threats pertaining to forests and biodiversity are integrated and threats to conservation should not be considered separately.

To respond to the many severe threats to Malagasy biodiversity, the Government of Madagascar (GOM) adopted its National Environmental Action Plan (NEAP) in 1989. The NEAP constitutes the principal environmental program in Madagascar, with various projects and activities implemented under it.

III. General Task

Under the direction of a team leader, the assessment team will evaluate biodiversity and tropical forest issues in Madagascar. The focus of activities under this assignment is threefold: 1) Assess the conservation status of biodiversity and forests in Madagascar; 2) identify actions to better conserve biodiversity and tropical forests; and 3) describe how and to what extent operational plans meet or could meet conservation actions proposed, as well how to meet the integrated needs of the tropical forest and biodiversity.

IV. Specific Tasks

The assessment team shall perform the following activities:

A) Data Collection:

- Prior to departure, meet or phone the Bureau Environmental Advisor, other Bureau for Africa technical staff, and other Washington, D.C.-based organizations to gather information on regional and Madagascar programs and agency environmental regulations.
- Obtain, review, and analyze documentation on biodiversity conservation (and tropical forest conservation) in Madagascar, such as that prepared by government agencies, bilateral donors, and national and international NGOs. Available online materials will be gathered prior to the country visit (links to literature are in Section VII).
- Meet with USAID/Madagascar to get an understanding of the Mission's ongoing sectoral assessments, program goals, and objectives under its current and proposed strategies. The Mission may provide the team with advice and protocol on approaching USAID partners and host country organizations with respect to this

assignment. The team will discuss organizations to be contacted and any planned site visits with the Mission and coordinate as required.

- Meet with ministries and agencies, donor organizations, international NGOs, and other organizations and gather information on forest and biodiversity conservation, crosscutting issues, or noteworthy projects.
- Conduct three priority site visits to supplement the understanding gained from interviews, literature, and second-hand sources.

B) Analysis

- Summarize the status of biodiversity and tropical forests in Madagascar.
- Summarize the social, economic, institutional, legal, and policy context for their use and conservation, including actions currently being taken by government, other donors, NGOs, and the private sector.
- Identify critical needs that should be addressed for the strategy to positively influence the conservation of tropical forests, biodiversity, and water resources and improve the sustainable management of natural resources in Madagascar.
- Identify the key direct and indirect threats to biodiversity and tropical forests. Identify the actions necessary to conserve and sustainably manage natural resources, biodiversity and tropical forests in Madagascar based on an analysis of country donor and NGO responses currently in place to meet these needs.
- Analyze the existing Mission portfolio and proposed USAID/Madagascar Operational Plan through an environment lens and identify some environmental threats and opportunities in each strategic area of intervention including their potential impacts on FAA section 117, 118 and 119 issues and climate.

C) Report:

- Update the 2002 ETOA assessment describing the status of biodiversity conservation and actions to conserve tropical forests in Madagascar, including implications for USAID or donor programming defines conservation actions. This report shall clearly meet the legal requirement of FAA Sec 118 and 119. An illustrative outline for the report is provided below.
- Drawing on the report (even before it is finalized, if necessary), the consultant shall produce the mandatory Environmental Annex required for the USAID/Operational Plan. This annex should be 8 to10 pages, and address explicitly the FAA 118-119 concerns in tropical forestry and biodiversity, key threats and opportunities for USAID/Madagascar's response, and recommended actions. These will be taken up as appropriate in the USAID/Madagascar Operational Plan and Country Assistance Strategy.

Illustrative Outline:

a. Introduction, describing the biophysical/human/economic contexts, environmental laws, policy and institutions, overview of environmental programs and initiatives, and the purpose of the present review
b. An overview of the state of the natural resources, including forests and terrestrial biodiversity, aquatic ecosystems, and agricultural resources
c. An analysis of past and current initiatives in Madagascar

d. Opportunities and entry points for USAID/Madagascar, including integrated threats analysis, optimal results areas, analysis of legal requirements under the FAA, interventions of other donors, recommendations of environmental experts and recommendations of opportunities and entry points.
e. All references used and cited in the report, including Web URLs, people consulted, and their institutional affiliation, endangered and protected species and authors' biographical data. Other references such as the SOW for the analysis, other background or supporting material, including maps and photographs should be included. Copies of key document, maps and images, and copies of photographs obtained during the assessment should also be appended in a CD-ROM with electronic versions of written materials.

V. Deliverables

The primary deliverable under this task order is the above referenced report with an assessment of: (1) The status of biodiversity and forest conservation in Madagascar; (2) analysis of past and current actions necessary in Madagascar to conserve tropical forests and biological diversity, and (3) opportunities and entry points for USAID/Madagascar.

There shall be seven deliverables under this activity:

1. Preliminary work plan and schedule: The contractor shall provide USAID with a work plan and schedule prior to traveling to Madagascar.
2. Progress report to the CTO and MEO after 10 working days from the start date (o/a February 14, 2008.
3. Oral debriefing within five working days preceding the departure date. The team shall meet with USAID/Madagascar to provide them with a brief of the report findings. The exit brief shall be accompanied by a short written summary of initial key findings and recommendations.
4. Draft report: The contractor shall submit a draft report to the Mission Environment Officer and USAID/Southern Africa Regional Environmental Advisor (as necessary) no later than March 7, 2008.The draft report shall follow the generic outline discussed above, as refined during the course of the contract in consultation with USAID.
5. Final report: Following a two-week comment and review period, a revised final report incorporating all comments will be submitted within two weeks of the review period end date. (April 1, 2008).
6. Ten copies of the bound final draft will be made available when the final is approved by the Mission, as well as electronic copies in MS Word and Adobe Acrobat PDF.
7. A short (8 to10 pages) Environmental Plan (Tropical Forestry and Biodiversity) Annex, which consists of a summary and syntheses of the findings and recommendations of the assessment, including recommended actions for USAID/Madagascar within its strategic areas.

ANNEX B

FOREIGN ASSISTANCE ACT SECTIONS 118 AND 119

Part I, Section 118\73\ — Tropical Forests

(a) Importance of Forests and Tree Cover. — In enacting section 103(b)(3) of this Act the Congress recognized the importance of forests and tree cover to the developing countries. The Congress is particularly concerned about the continuing and accelerating alteration, destruction, and loss of tropical forests in developing countries, which pose a serious threat to development and the environment. Tropical forest destruction and loss —

(1) Result in shortages of wood, especially wood for fuel; loss of biologically productive wetlands; siltation of lakes, reservoirs, and irrigation systems; floods; destruction of indigenous peoples; extinction of plant and animal species; reduced capacity for food production; and loss of genetic resources; and —

(2) Can result in desertification and destabilization of the earth's climate. Properly managed tropical forests provide a sustained flow of resources essential to the economic growth of developing countries, as well as genetic resources of value to developed and developing countries alike.

(b) Priorities. — The concerns expressed in subsection (a) and the recommendations of the United States Interagency Task Force on Tropical Forests shall be given high priority by the President —

(1) In formulating and carrying out programs and policies with respect to developing countries, including those relating to bilateral and multilateral assistance and those relating to private sector activities; and —

(2) In seeking opportunities to coordinate public and private development and investment activities which affect forests in developing countries.

(c) Assistance to Developing Countries. — In providing assistance to developing countries, the President shall do the following:

(1) Place a high priority on conservation and sustainable management of tropical forests.

(2) To the fullest extent feasible, engage in dialogues and exchanges of information with recipient countries —

(A) Which stress the importance of conserving and sustainably managing forest resources for the long-term economic benefit of those countries, as well as the irreversible losses associated with forest destruction, and —

(B) Which identify and focus on policies of those countries which directly or indirectly contribute to deforestation.

(3) To the fullest extent feasible, support projects and activities —

(A) Which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and —

(B) Which help developing countries identify and implement alternatives to colonizing forested areas.

(4) To the fullest extent feasible, support training programs, educational efforts, and the establishment or strengthening of institutions which increase the capacity of developing countries to formulate forest policies, engage in relevant land-use planning, and otherwise improve the management of their forests.

(5) To the fullest extent feasible, help end destructive slash-and-burn agriculture by supporting stable and productive farming practices in areas already cleared or degraded and on lands which inevitably will be settled, with special emphasis on demonstrating the feasibility of agroforestry and other techniques which use technologies and methods suited to the local environment and traditional agricultural techniques and feature close consultation with and involvement of local people.

(6) To the fullest extent feasible, help conserve forests which have not yet been degraded, by helping to increase production on lands already cleared or degraded through support of reforestation, fuel wood, and other sustainable forestry projects and practices, making sure that local people are involved at all stages of project design and implementation.

(7) To the fullest extent feasible, support projects and other activities to conserve forested watersheds and rehabilitate those which have been deforested, making sure that local people are involved at all stages of project design and implementation.

(8) To the fullest extent feasible, support training, research, and other actions which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing, including reforestation, soil conservation, and other activities to rehabilitate degraded forest lands.

(9) To the fullest extent feasible, support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation, including research in agroforestry, sustainable management of natural forests, small-scale farms and gardens, small-scale animal husbandry, wider application of adopted traditional practices, and suitable crops and crop combinations.

(10) To the fullest extent feasible, conserve biological diversity in forest areas by —

(A) Supporting and cooperating with United States Government agencies, other donors (both bilateral and multilateral), and other appropriate governmental, intergovernmental, and nongovernmental organizations in efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis;

(B) Whenever appropriate, making the establishment of protected areas a condition of support for activities involving forest clearance of degradation; and —

(C) Helping developing countries identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas.

(11) To the fullest extent feasible, engage in efforts to increase the awareness of United States Government agencies and other donors, both bilateral and multilateral, of the immediate and long-term value of tropical forests.

(12) To the fullest extent feasible, utilize the resources and abilities of all relevant United States Government agencies.

(13) Require that any program or project under this chapter significantly affecting tropical forests (including projects involving the planting of exotic plant species) —

(A) Be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land, and —

(B) Take full account of the environmental impacts of the proposed activities on biological diversity, as provided for in the environmental procedures of the Agency for International Development.

(14) Deny assistance under this chapter for —

(A) The procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner which minimizes forest destruction and that the proposed activity will produce positive economic benefits and sustainable forest management systems; and —

(B) Actions which significantly degrade national parks or similar protected areas which contain tropical forests or introduce exotic plants or animals into such areas.

(15) Deny assistance under this chapter for the following activities unless an environmental assessment indicates that the proposed activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development:

(A) Activities which would result in the conversion of forest lands to the rearing of livestock.

(B) The construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undegraded forest lands.

(C) The colonization of forest lands.

(D) The construction of dams or other water control structures which flood relatively undegraded forest lands.

(d) PVOs and Other Nongovernmental Organizations. — Whenever feasible, the President shall accomplish the objectives of this section through projects managed by private and voluntary organizations or international, regional, or national nongovernmental organizations which are active in the region or country where the project is located.

(e) Country Analysis Requirements. — Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of —

(1) The actions necessary in that country to achieve conservation and sustainable management of tropical forests, and —

(2) The extent to which the actions proposed for support by the Agency meet the needs thus identified.

(f) Annual Report. — Each annual report required by section 634(a) of this Act shall include a report on the implementation of this section.

Part I, Section 119\75\ - Endangered Species

(a) The Congress finds the survival of many animal and plant species is endangered by overhunting, by the presence of toxic chemicals in water, air and soil, and by the destruction of habitats. The Congress further finds that the extinction of animal and plant species is an irreparable loss with potentially serious environmental and economic consequences for developing and developed countries alike. Accordingly, the preservation of animal and plant species through the regulation of the hunting and trade in endangered species, through limitations on the pollution of natural ecosystems, and through the protection of wildlife habitats should be an important objective of the United States development assistance.

\75\ 22 U.S.C. 2151q. Sec. 119, pars. (a) and (b) were added by sec. 702 of the International Environment Protection Act of 1983 (title VII of the Department of State Authorization Act, Fiscal Years 1984 and 1985, Public Law 98-164; 97 Stat. 1045).

(b) \75\ In order to preserve biological diversity, the President is authorized to furnish assistance under this part, notwithstanding section 660,\76\ to assist countries in protecting and maintaining wildlife habitats and in developing sound wildlife management and plant conservation programs. Special efforts should be made to establish and maintain wildlife sanctuaries, reserves, and parks; to enact and enforce anti-poaching measures; and to identify, study, and catalog animal and plant species, especially in tropical environments.

\76\ Section 533(d)(4)(A) of the Foreign Operations, Export Financing, and Related Programs Appropriations Act, 1990 (Public Law 101-167; 103 Stat. 1227), added ``notwithstanding section 660'' at this point.

(c) \77\ Funding Level. — For fiscal year 1987, not less than $2,500,000 of the funds available to carry out this part (excluding funds made available to carry out section 104(c)(2), relating to the Child Survival Fund) shall be allocated for assistance pursuant to subsection

(b) for activities which were not funded prior to fiscal year 1987. In addition, the Agency for International Development shall, to the fullest extent possible, continue and increase assistance pursuant to subsection (b) for activities for which assistance was provided in fiscal years prior to fiscal year 1987.

\77\ Pars. (c) through (h) were added by sec. 302 of Public Law 99- 529 (100 Stat. 3017).

(d) \77\ Country Analysis Requirements. — Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of —

(1) The actions necessary in that country to conserve biological diversity, and

(2) The extent to which the actions proposed for support by the Agency meet the needs thus identified.

(e) \77\ Local Involvement. — To the fullest extent possible, projects supported under this section shall include close consultation with and involvement of local people at all stages of design and implementation.

(f) \77\ PVOs and Other Nongovernmental Organizations. — Whenever feasible, the objectives of this section shall be accomplished through projects managed by appropriate private and voluntary organizations, or international, regional, or national nongovernmental organizations, which are active in the region or country where the project is located.

(g) \77\ Actions by AID. — The Administrator of the Agency for International Development shall — (1) cooperate with appropriate international organizations, both governmental and nongovernmental;

(2) Look to the World Conservation Strategy as an overall guide for actions to conserve biological diversity;

(3) Engage in dialogues and exchanges of information with recipient countries which stress the importance of conserving biological diversity for the long-term economic benefit of those countries and which identify and focus on policies of those countries which directly or indirectly contribute to loss of biological diversity;

(4) Support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity;

(5) Whenever possible, enter into long-term agreements in which the recipient country agrees to protect ecosystems or other wildlife habitats recommended for protection by relevant governmental or nongovernmental organizations or as a result of activities undertaken pursuant to paragraph;

(6) And the United States agrees to provide, subject to obtaining the necessary appropriations, additional assistance necessary for the establishment and maintenance of such protected areas;

(6) Support, as necessary and in cooperation with the appropriate governmental and nongovernmental organizations, efforts to identify and survey ecosystems in recipient countries worthy of protection;

(7) Cooperate with and support the relevant efforts of other agencies of the United States Government, including the United States Fish and Wildlife Service, the National Park Service, the Forest Service, and the Peace Corps;

(8) Review the Agency's environmental regulations and revise them as necessary to ensure that ongoing and proposed actions by the Agency do not inadvertently endanger wildlife species or their critical habitats, harm protected areas, or have other adverse impacts on biological diversity (and shall report to the Congress within a year after the date of enactment of this paragraph on the actions taken pursuant to this paragraph);

(9) Ensure that environmental profiles sponsored by the Agency include information needed for conservation of biological diversity; and

(10) Deny any direct or indirect assistance under this chapter for actions which significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas.

(h) \77\ Annual Reports. — Each annual report required by section 634(a) of this Act shall include, in a separate volume, a report on the implementation of this section.

ANNEX C

ENVIRONMENTAL ANALYSIS — MADAGASCAR

(Based on the Environmental Threats and Opportunities Assessment, April 2008)

I. INTRODUCTION

USAID/Madagascar is preparing to develop a new five-year Integrated Strategic Plan (ISP) for 2009-2013. As a mandatory technical analysis requirement of the ISP (see USAID's Automated Directive System, ADS 201.3.4.11), field work to update the 2002 Environmental Threats and Opportunities Assessment (ETOA) was done in February 2008. The 2008 updated ETOA describes the status of and actions necessary to conserve biodiversity and tropical forests in Madagascar.

This annex examines environmental threats and opportunities inherent to the Mission's strategy, and assesses the extent to which that strategy incorporates tropical forests and biodiversity concerns. It is not a substitute for an Initial Environmental Examination (IEE). Each Strategic Objective (SO) team is responsible for ensuring that an IEE, or Request for a Categorical Exclusion, is conducted at the SO-level for all USAID-funded activities.

II. BACKGROUND

A. FAA Section 118 Requirements — Tropical Forest Conservation

In response to the accelerated loss of tropical forests worldwide, the U.S. Congress enacted Section 118 of the FAA, which acknowledges the important role tropical forests and tree cover play in developing countries (in the daily lives of their people, and in their economies overall). Section 118 recognizes the financial value of tropical forests; it also cites benefits that are not directly financial in nature: forests as wildlife habitats, as diverse genetic resource pools, and as protection against erosion and siltation of water bodies and loss of soil fertility and floods.

Section 118 states that the U.S. government support to developing countries shall, to the fullest extent feasible: help end destructive agricultural practices; help conserve forests that have not yet been degraded; support activities that will conserve and rehabilitate forested watersheds; support training, research, and activities that lead to sustainable practices for timber harvesting; and support research to develop alternatives to forest destruction.

B. FAA Section 119 Requirements — Biodiversity

The U.S. Congress enacted Section 119 of the FAA in response to the irreparable loss of plant and animal species occurring in many developing countries, and the environmental and economic consequences of that loss. Section 119 addresses biodiversity conservation concerns by encouraging USAID to furnish assistance to protect and maintain wildlife habitats, develop sound wildlife management and plant conservation programs, establish and maintain wildlife sanctuaries, enforce anti-poaching measures, and identify and study animal and plant species.

Section 119 states that ongoing and proposed actions of USAID shall not inadvertently endanger wildlife or critical habitats, harm protected areas, or have other adverse impacts on

biological diversity. It also says that USAID programs shall, to the fullest extent feasible, support policies, training and education, and long-term agreements and other types of cooperation efforts that will result in the conservation of biodiversity.

III. MADAGASCAR BIODIVERSITY AND TROPICAL FORESTS

Biodiversity. Madagascar has been identified by the international community as a megadiversity hotspot. This is due to a combination of factors, including high levels of species diversity, endemism, and degree of threat. Madagascar's flora accounts for about 12,000 species, of which approximately 10,000 are forest dependent. Most of the remaining native flora is forest associated; 81 percent to 86 percent of those are endemic. Some 280 species are included in the International Union for Conservation of Nature (IUCN) Red List of threatened species. A substantial proportion (33 percent) of the native flora consists of trees or shrubs, of which 96 percent are endemic. Madagascar alone harbors more orchid species than does the entire African continent. Currently, there are 30 plant species from Madagascar that are on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (export of all species is forbidden, with few and strict exceptions). There are 353 plant species on CITES Appendix II (export of all species is strictly controlled).

With respect to fauna, 3,317 taxa of terrestrial macrofauna have been identified on the island. Of these, more than 90 percent are forest associated or restricted. Within the mammal taxon, 156 species have been inventoried, including at least 49 species of lemurs, all endemic to Madagascar. Endemism in other mammal groups is high: insectivores 97 percent, rodents 89 percent, and carnivores 87 percent. More than 90 percent of mammals are restricted to forest habitats. Some 262 species are included in the IUCN Red List of threatened species. Currently, there are 85 animal species that are on CITES Appendix I, and 610 animal species on CITES Appendix II.

The reptile category includes 333 species, of which 91.6 percent (305 species) are endemic. Of the 65 genera of reptiles, 60.3 percent are endemic. There are 182 amphibian species in Madagascar (of which 179 are frogs); 98.4 percent of those are endemic. Of the 18 amphibian genera, 83.3 percent are endemic to Madagascar. The majority of amphibians are forest restricted and most are confined to dense humid forests, such as those found in the southeast (Glaw and Vences in Lourenço and Goodman, 2000). At least 42 to 68 amphibian and 24 to 34 reptile species are still awaiting description or "resurrection" (Glaw and Vences in Lourenço and Goodman, 2000).

Madagascar has 258 species of birds. While this is a low number in comparison with other African countries, 120 of these species are endemic and around 100 are forest restricted. Marine and coastal biodiversity inventories are much less complete and have been done only in certain areas. Of the 10,627 marine species known from the coastal waters of the Indian Ocean, the Great Toliara Reef — the largest barrier reef in southwest Indian Ocean and the third longest barrier reef in the world — harbors more than 5,500 marine species (MinEnvEF, 2006).

Of the 143 native freshwater fishes, recognized in Madagascar, belonging to 21 families and 54 genera, more than 65 percent are endemic to Madagascar (Sparks and Stiassny 2003). Some 73 percent are estimated to be threatened with extinction (22 percent critically endangered, 34 percent endangered and 17 percent vulnerable under IUCN criteria). The

combination of deforestation, overfishing, and exotic species introduction has affected most of the island's freshwater habitats, making freshwater fishes Madagascar's most threatened vertebrate taxa (Benstead, et. al. 2003).

Tropical Forests. There are five types of forests in Madagascar. The north and the east are characterized by dense humid forests (low, middle, and high altitudes). The most important dense humid forest blocks are found around the Masaola peninsula and on the Mananara coast (northeast). The remainder of the humid forest occur from Mananara to Tolañaro in the southeast as a narrow, fragmented corridor. Dense dry forests and mangrove/littoral forests are the principal forest types found in the west. Spiny forests are found in the sub-humid and arid south and southwest.

Malagasy forests comprise 4,220 known species of trees and large shrubs. An analysis of the tree flora reveals that 33 percent of the 490 indigenous genera with tree species are endemic to Madagascar. The 329 non-endemic genera are represented by an additional 3,280 species of trees and large shrubs, of which 95 percent are endemic (Schatz in Lourenço and Goodman, 2000).

Analysis of aerial photographs (c. 1953) and Landsat images (c. 1973, c. 1990 and c. 2000) indicates that forest cover decreased by almost 40 percent from the 1950s to c. 2000, with a reduction in "core forest" — defined as forest areas more than one kilometer from a non-forest edge — of almost 80 percent (Harper, et. al., 2007). Total forest cover is estimated to have been 10,668,800 ha in 1990 and 9,216,617 ha in 2005, representing a loss of 13.6 percent during that period. Annual forest loss during the 1990-2000 period was estimated to have been 0.83 percent, and annual forest loss during the 2000-2005 period was estimated to have been 0.53 percent (Table 2.1).

Table 3.1. Forest Cover Changes in Madagascar, 1990-2005 (MinEEFT, et.al., November 2007)

Forest Cover Metric	Hectares
Total land surface area, Madagascar:	59,263,558
Forest cover in:	
1990	10,668,800 (18.0%)
2000	9,677,701 (16.3%)
2005	9,216,617 (15.6%)
Deforestation Rates	
Base area used for calculation, 1990 *	9,587,774
Deforested, 1990-2000	791,264
Annual deforestation rate, 1990-2000: 0.83%	
Base area used for calculation, 2000 *	8,845,587
Deforested, 2000-2005	236,560
Annual deforestation rate, 2000-2005: 0.53%	

*Because parts of the satellite images can be obscured by clouds, potential biases in estimates of rates can arise. Authors provide a best estimate of remaining forest cover in 2005 — "Forest Cover." They also provide an estimate of the rate of change in percentage per year that is unbiased because they did not include any areas that were obscured by clouds in either of the two dates in question. The area of forest that was not obscured by clouds is the "calculated" (forest) base, and was used as the base area in the estimation of the deforestation change rate.

Dry forests in the southwest are made up of more than 1,000 species, of which more than 90 percent are endemic (Toliara Biosphere Proposal, 2001). The dune bush of southwest Madagascar comprises at least 112 species, 95 percent of which are endemic, which is unusually high for littoral forests.

Forests in Madagascar are viewed and used as a source of products such as fuel, building materials, fruits and seeds, and medicine. Local people's livelihoods heavily depend on forest resources, especially fuel and building materials. In 1998, it was estimated that 96 percent of collected forest products in Madagascar consisted of wood for household consumption, especially in the form of charcoal. Most importantly, Malagasy people regard forests as places to acquire land for the expansion of agricultural production. They usually change such lands through slash and burn agriculture (a process called *tavy* in the Malagasy language). At the national level, forest resources are considered a source of foreign currency and energy: 75 percent of forest export revenues in Madagascar are generated through the export of timber.

In sum, tropical forests and tropical forest biodiversity are closely entwined. Forests (like freshwater, marine and coastal ecosystems) are a sub-component of the varied ecosystems and species that contribute to the very rich and threatened biodiversity of Madagascar. Issues and threats pertaining to forests and biodiversity are integrated, and issues concerning their principal threats and conservation should not be considered separately.

IV. TROPICAL FOREST AND BIODIVERSITY CONSERVATION IN MADAGASCAR

To respond to the many severe threats to Malagasy biodiversity, the Government of Madagascar (GOM) adopted a National Environmental Action Plan (NEAP) in 1989. The NEAP constituted the principal environmental program in Madagascar at that time, with various projects and activities implemented under it. In 2007 the country adopted the Madagascar Action Plan (MAP), which establishes direction, commitments, and priorities for the nation in eight distinct sectors for the years 2007-2012. The eight MAP commitments are to build human, infrastructure, private sector, natural, leadership, and knowledge capital for the nation. While all commitments will have at least indirect influences on the environment, Commitment 7 – "Cherish the Environment – is to "care for, cherish and protect our extraordinary environment." Under this commitment, efforts are underway to meet four environmental challenges:

- Increase the protected areas for the conservation of land, lake, marine and coastal biodiversity
- Reduce the natural resource degradation process
- Develop the environmental reflex at all levels
- Strengthen the effectiveness of forest management

The following is a summary of NEAP – and now MAP – programs that have a direct relation to biodiversity and forest conservation in Madagascar.

A. Biodiversity Conservation In and Around Protected Areas

The first protected areas were created in the 1920s, and there are now 46 throughout Madagascar: 23 special reserves, 18 national parks, and five integral natural reserves (Figure 1). These 46 protected areas cover approximately 3 percent of the island, and include 12.8

percent of Madagascar's remaining total forest cover. They are all managed by the National Association for the Management of Protected Areas (ANGAP). ANGAP's mission is to establish, conserve, and manage a national network of parks that are representative of Madagascar's biological diversity and natural heritage. One protected area, Tsingy de Bemaraha Strict Nature Reserve, has been a designated a World Heritage Site since 1990. In 2007, the Rainforests of the Atsinanana, which comprise six national parks distributed along the eastern part of the island, were declared a World Heritage Site. These relic forests are critically important for maintaining ongoing ecological processes necessary not only for the survival much of Madagascar's unique biodiversity, but also to support downstream water uses, and agricultural, development, and other economic and social values.

In September 2003 the GOM made a bold commitment to conserve the nation's wealth of natural resources and biodiversity by tripling the protected area network from the existing 1.7 million hectares to 6 million hectares, or 10 percent of the country's surface area, in the coming five years. Made by the President of the Republic of Madagascar at the Vth World Parks Congress in Durban, South Africa, this commitment has become known as the "Durban Vision." New protected areas will be managed through collaboration between the government, funding agencies, nongovernmental organizations, the private sector and individuals at all levels. A more flexible approach to protected area management has been adopted with the aim of maximizing direct and indirect uses of natural resources while also safeguarding biodiversity. Most of the new protected areas will not be managed by ANGAP, but could be managed by the Directorate General of Waters and Forests (DGEF, part of the Ministry of Environment, Water and Forests and Tourism — MEEFT), or its regional offices (*Direction Interrégionale de l'Environnement, des Eaux et Forêts* — DIREEF or *Circonscription de l'Environnement et des Eaux et Forêts* — CIREEF), by nongovernmental organizations, by community organizations, by private sector organizations, or by a combination of these through collaborative management agreements. Between 2003 and 2006, Madagascar gave provisional protected area status to 20 additional sites, totaling approximately 2 million ha. Final protected area status for several of these sites is expected later in 2008.

All Madagascar's protected areas will be part a single national system of protected areas (*Système d'Aires Protégées de Madagascar* — SAPM), including existing ANGAP-managed and future new protected areas. The three fundamental objectives of the SAPM are to:

- Conserve the entirety of Madagascar's unique biodiversity (ecosystems, species, genetic variability),
- Conserve Madagascar's cultural heritage,
- Maintain ecological services and promote sustainable use of natural resources to contribute to the reduction of poverty and sustainable development.

B. Forests Outside the Protected Area System

There are three categories of forests — classified forests, forest reserves and "*forêts domaniales*"— which fall outside the management scope and rules of the protected areas. These forest areas represent approximately 87 percent of the island's remaining forest cover and are managed by the MEEFT.

During the last 10 years, one of the Malagasy government's main objectives has been to promote and "expand conservation and development activities beyond national parks and

reserves into a regionalized landscape [ecology] approach focused on identifying and protecting key biodiversity conservation zones (e.g., corridors)." The key goals under this landscape approach are to improve governance of the forestry sector, to sustain community-based forest management, and to promote the regional approach to forest, marine, coastal, and overall biodiversity conservation.

C. Community-Based Management

The first law promoting the management transfer of renewable natural resources to local communities was promulgated in September 1996 (Law 96-025). It is known as the GELOSE law (*Gestion Locale Sécurisée*).

In February 2000, the GOM approved the GCF — Forest Management Contracts — decree, which transfers management of forests to local communities. The GCF decree falls under the GELOSE law, and puts a specific emphasis, using simplified procedures, on community-based forest management. GCF defines clear forest management plans, annual operational plans, and resource accounting instruments. Through training and support programs, GCF strives to improve the management and negotiation capacities of local communities.

Several initiatives, including those supported by USAID, are being implemented under such contracts.

D. Improved Forest Management

A special program was designed under the NEAP to promote greater transparency, accountability, and improved governance in the forestry sector, with an emphasis on:

- Enforcement of decrees defining forest product exploitation in and around sensitive areas, and restricting the export of logs of high value timber. In this respect, the GOM is required to apply effective legal proceedings against offenders. It is also expected that the inter-ministry committee for the environment and the national council for the environment will, with support from high levels of government, actively apply the decrees at every level;

- Establishment of a transparent system for the issuance of new cutting permits. Permit issuance should be in accordance with a system of checks and balances with the participation of the Ministry of the Environment, Water and Forests and Tourism, the regional and local authorities, and community-based organizations;

- Improvement of the management of the national and regional forestry funds, by ensuring a transparent monitoring of the collection system and establishing a mechanism for disbursing funds at all levels; and

- Creation of independent forest observatories at the national and regional levels. These observatories should contribute to the monitoring of forest resource management and the collection of forest use taxes.

E. Eco-Regional Approach

One of Madagascar's most important innovations with regard to biodiversity conservation has been to expand conservation and development activities beyond national parks and reserves into a regionalized "landscape approach," i.e., identifying and protecting key biodiversity conservation zones, such as forest corridors and coastal zones. This eco-regional, landscape-based approach seeks to influence how humans interact with their environment, and also seeks to ensure a sustainable use of natural resources in the broader landscape.

F. Zoning

The zoning of Malagasy forests is a critical condition to facilitating better management of the nation's forests. The purpose of zoning is to help provide a strategic vision for forest management over a given period of time. Zoning facilitates greater transparence as well as improved management, because activities that contradict the goal of a particular zone will be more evident to observers.

V. MAIN THREATS TO BIODIVERSITY AND TROPICAL FORESTS

This ETOA identifies the following main threats to biodiversity and forests in Madagascar:

A. Slash and Burn Agriculture (*Tavy*)

The practice of slash and burn remains the largest cause of forest cover loss and of biodiversity associated with forests. Tavy is a complex issue, and one which encompasses a variety of social, cultural, biological, economic, and land tenure issues. Tavy is a culturally based practice dating back hundreds of years, and is a custom ingrained in rural society. Due to perverse land tenure laws, tavy is used as a traditional means of increasing family lands, an emergency stopgap measure to produce crops after a cyclone, and a standard form of agriculture for rural communities. No other economically profitable activity for the forest is evident to most local producers, particularly given the fact that responsibility for the forests is in the hands of the government, not the communities. There is little incentive to sustainably manage these resources. Because the practice is carried out on steep slopes and fragile soils, production is low and soil erosion is high, making these lands only valuable for a few years. This in turn pushes the rural farmer to undertake new tavy. Furthermore, regeneration of Malagasy forest is a long process that may take hundreds of years — the deciduous forest, the eastern rainforest, and the southern spiny forests take the longest time to regenerate — and no regeneration of primary indigenous forest has been reported in Madagascar during the past 50 years. When these factors are combined with population growth of 2.8 percent per year, it becomes evident that there is a huge demand for the lands on which the last remaining Malagasy forests reside. This traditional practice remains widely used despite educational efforts by various NGOs, donors, and the GOM. As shown in fire maps, it is a primary cause of deforestation around protected areas, although its prevalence within protected areas has diminished.

B. Population Pressures

Continued population growth rates exacerbate pressures on all types of ecosystems. High density rates and high population growth constitute a serious threat to the existence of the remaining humid, mangrove, dry and spiny forests. More mouths to feed and fixed amounts of land translate into higher levels of resource exploitation. As their intensity and amounts

increase, traditional practices are often not environmentally friendly or sustainable. Migration from poorer or afflicted communities far from existing and proposed protected areas to lands in and around protected areas illustrate the tendency for Malagasies to turn to the forest and ocean resources during hard times.

C. Energy Needs, Logging, and Mangrove Deforestation

In Madagascar, rural people's livelihoods depend heavily on forest resources. The 2002 ETOA estimated that, in 1998, 96 percent of collected forest products in Madagascar consisted of wood for household consumption, especially in the form of charcoal. In recent years, there has been significant loss of mangroves, as they have been cut to provide fuel wood and charcoal for surrounding communities. Mangroves are essential components of functional and stable coastal and marine ecosystems, and valuable forests in themselves. The GOM is in the process of reforming its energy sector to provide more alternative energy sources. In Madagascar, energy plays a central role in a rural area's ability to realize economic growth without causing irreplaceable damage to local natural resources. For example, in rural areas where agriculture is the predominate economic activity, adequate and affordable energy is required to increase crop yields and create added value opportunities in the processing and marketing of the crop without destroying local forests. However, even given the above, wood use as an energy source is a relatively minor factor in terms of overall annual forest loss.

Logging, both legal and illegal, is the third largest contributor to forest degradation and loss of precious wood species. Legal logging accounted for an average of 30 percent of total wood extraction in Madagascar, and increased steadily prior to the 2002 ETOA. In 1999, about 65,000 ha under license were harvested. Forty percent of that was located in the Toamasina province, which hosts some of the country's most biologically rich forest. It is illegal logging, however, that causes the most damage: in the same year (1999), 135,000 hectares of forest were illegally harvested. In practice, loggers cut around the concession before logging the concession itself, always able to claim later that the peripheral logging was a copycat activity. Forest mapping technology is entirely inadequate to enable district chiefs to verify whether the concession is operating within bounds and, in any event, only a small inducement is required to prevent reports of infractions.

D. Exploitation of Species for Wildlife Trade, Overfishing, and Other Illegal/Illicit Exploitation of Natural Resources

Illegal exploitation of natural resources continues to be an overarching concern, and one that could reduce the impact of efforts to help conserve Madagascar's biodiversity. Illegal exploitation has come increasingly under attack as unregulated and illegal exploitation of wildlife, forest products, precious minerals, and fisheries has expanded. Corruption and inadequate government management of natural resources and enforcement of CITES is one of the major constraints in the attainment of expected results at the field level.

Insufficient regulation on all types of fishing, including traditional fisheries, licensed and unlicensed long line vessels, has contributed to degradation of marine biodiversity in Madagascar. Unregulated exploitation of high value resources such as sea cucumbers and shark fins, and over-fishing in general, constitutes a real threat to the marine and coastal biodiversity in Madagascar.

Madagascar ratified the Convention on the International Trade of Endangered Species of Wild Fauna and Flora in 1975. Export quotas are tools used to monitor and regulate trade in species listed in the appendices to CITES. Under Appendix I — trade is forbidden except for research purposes — Madagascar has listed 85 animal species, including all lemurs, dugong, angonoka and radiated tortoises, sea turtles, whales, the boa, Acanthropus sp. snakes, peregrine falcon, Soumagne's owl, and 30 species of plants (e.g., pachypodium and aloes).

Under Appendix II — trade is controlled according to quotas and monitoring — Madagascar has listed 608 animal species, including the two fossa species and Malagasy mongoose, all raptors and owls, flamingos, Bernier's teal, parrots, all other terrestrial tortoises, the freshwater turtle Erymnochelys madagascariensis, all day geckos, all chameleons, the coelacanth, the Nile crocodile, fish species such as the whale shark, the great white shark, and the golden tree frog Mantella aurantiaca.

Under Appendix II, Madagascar has listed 353 plant species, including all aloes, all cacti, tree ferns, cycads, Didiereacea, Dicksonaceae, Ceropegia spp., Euphorbia spp., all orchids, Chrysalidocarpus spp., and the three-cornered palm (Neodypsis decaryi). The lists are far from complete, although officially Madagascar considers itself bound to enforce CITES lists irrespective of whether they have been declared under national law.

In 2005 Law 2005-018 established procedures for international trade to conform with CITES, strengthened protection of non-CITES wildlife species, defined infringements of the rules of international trade, and set deterrent penalties for violators. No specimen of any CITES-listed plant species, including seeds, spores, pollen, in vitro cultures and cut flowers, may be exported without an export permit.

To adhere to international CITES standards and support appropriate management decisions, the GOM has identified a need to develop and clarify national policies on the following CITES topics:

- Objectives for CITES management in Madagascar (see: MinEnvEF, 2006)
- Decentralization of enforcement
- Sharing commercial receipts received with the local communities where species or products are harvested
- Management policies for areas where imported species are held
- Criteria for allocation quotas and permits

E. Increases in Mining Operations

A recent increase in both large and small mining operations has been spurred by higher world market prices and economic stimulation policies. Large operations can have great impacts on ecological systems, especially forests. Mining in the north (Ankarana), which started in 1996, resulted in a 10 percent loss of forest (the Special Forest Reserve of Ankarana is 18,000 ha). Mining for nickel and cobalt in Ambatovy has resulted in very significant losses of primary forest. In addition to significant on-site alteration of vegetation caused by mining, associated large-scale erosion and increased population pressures can cause environmental disasters. Small-scale mining can irreparably damage forested areas, increasing fragmentation. Inter-ministry miscommunications have caused land use conflicts and last minute land grabs. Although the percentage of total forest loss nationwide from mining is relatively small, impacts may be more permanent, given the associated earthworks.

Legislation requires that a potential mining company prepare an environmental impact assessment before a mining permit is awarded.

F. Sedimentation from Soil Erosion

Slash and burn farming, logging, and mining are significant threats to soils, vegetation, and watershed conditions. Deforestation and poor agricultural practices have caused increased sedimentation of rivers, lakes, wetlands, and coastlines. This directly threatens the biodiversity and ecological stability of these areas. Surveys have shown that, before the 1980s, fallow periods averaged around eight years; one decade later, fallow periods have been reduced to two to five years. Such a short period barely allows the vegetation to reach a shrubby stage before land is returned to exploitation. Consequently, the agricultural land under exploitation has a reduced chance of recovering its vital nutrients. Over time, degradation in soil texture and soil erosion occurs. This phenomenon is visible in the southeast of Fianarantsoa province, between the coastal plain and the mid-altitude tropical forest.

Logging and slash and burn also contribute to the degradation of watersheds. This is especially grave, given that water quantity and quality is a vital — and, in some areas of the country, very rare — agricultural resource.

G. Climate Change

Global warming affects all ecosystems in potentially disastrous proportions. Forest corridors will be further invaded by agriculture as the ability to cultivate at higher elevations becomes possible. Coral reefs become bleached and lifeless. Rising sea temperatures and levels drastically affect coastal and marine systems. The gradual drying of areas in the southwest and west increase food insecurity, and increase pressures on forest, soil and water resources. Increasing cyclone activity poses increasing threats to infrastructure and agriculture.

H. Inefficient and Traditional Agriculture

These practices lead to increased soil infertility, poor harvests, and food insecurity. Rice, as a primary staple of Madagascar and requiring high amounts of water, is dependent on sound upstream watershed protection and management. Use of traditional agricultural practices will not meet needs caused by population growth.

In addition to the above-identified direct threats, there also exist indirect threats to Madagascar's natural resources. These include:

- *Lack of institutional capacity.*The lack of institutional capacity refers not only to having inadequate management resources, but also to training and institutional support of ministry and agency personnel. Improving institutional capacity is acknowledged by donors, NGOs, government ministries, and local communities as a very important need to be addressed. Institutional instability and the large expansion of responsibilities of the MEEFT, by way of the Durban Vision and mining activities, further highlight the necessity for capacity training and development if the ministry is to be effective in administering new protected areas and performing other responsibilities, particularly at the regional level.

- *Weak market infrastructure and linkages.*Promotion of alternative livelihoods key to natural resource conservation as forests are a resource and an income generator for communities. Market infrastructure linkages directly support the development of alternative livelihoods, such as ecotourism, agricultural production increases and diversification, and trade. Weak infrastructure and linkages not only discourage these activities, but impede them.

    - *Land tenure.*The lack of a strong land tenure system, and ill-defined property rights in general, discourage agricultural intensification practices. They hamper protection and regeneration of natural resources. It encourages traditional agricultural practices such as tavy, which results in forest losss, soil erosion and loss of soil fertility. The lack of land for future rice cultivation is a major threat to agricultural production.

VI. RECOMMENDATIONS FOR IMPROVED BIODIVERSITY AND TROPICAL FOREST CONSERVATION IN MADAGASCAR

A. Slash and Burn Agriculture

- Agricultural education, intensification, and diversification efforts such as those implemented in the ERI project, should be continued.
- Monitoring through community management of forest zones should be supported to the extent that it is entrenched and sustainable.
- These practices should be expanded beyond the forest corridor in which USAID is currently active, especially to the spiny and dry forests of the south.
- Support community-based management of natural resources.
- Promote agro-ecological techniques in agricultural production to help reduce forest loss, promote rice cultivation, etc.
- Promote dairy cultivation (in the mid-western part of the country).
- Improve production of and diversification into high value crops.
- Support local pilot forestry projects.
- Support conservation contracts for forest management.
- Support reforestation and soil conservation/restoration programs.
- Promote industrial development in cities that encourages migration of labor from forests.

B. Population Pressure

- Promote agricultural intensification away from forest blocks.
- Promote agro-ecological techniques in agricultural production to help reduce forest loss.
- Promote environmental education.
- Encourage behavioral changes from traditional practices to holistic approaches.
- Support food security projects, particularly related to agriculture intensification, diversification, and commercialization to decrease pressures on resources.
- Develop market infrastructure to encourage further income generation and alternative livelihoods.
- Encourage family planning and education endeavors to complement such efforts, as well as social programs to mitigate migration effects.

C. Energy Needs, Logging, and Mangrove Deforestation

- Help implement trade controls on hardwoods, including obligatory certification of sustainable harvesting.
- Support intensive reforestation programs through environmental education and awareness-raising activities.
- Promote the sustainable use of forest products for the benefit of local communities.
- Improve forest sector governance, especially institutional development within the MEEFT, as it plays the key role in implementing Commitment 7 of the MAP.
- Help the forestry industry become more competitive and sustainable.
- Assist in enforcement of legal texts such as the Mise en compatibilité des Investissements avec l'Environnement (MECIE) decree (99-954 of December 1999) that requires that all forest exploitation of more than 150 ha (including mining activities) comply with environmental impact assessment provisions.
- Support local pilot forestry projects.
- Support carbon sequestration schemes.
- Improve forest sector governance, especially institutional development within the Ministry of EnvEFT.
- Madagascar has numerous opportunities surrounding the use of various energy sources to enhance economic growth in rural areas — while reducing the need to exploit local natural resources for short-term economic gain.
- Intervention activities worth considering include: (i) reduce the need to extract forest resources by reducing dependence on fuel wood for cooking with alternative energy sources and technologies. This will reduce pressure to harvest fuel wood from protected areas; (ii) increase agricultural productivity by utilizing residues from rice or other crops to create biomass energy for value-added processing of agricultural products; and (iii) improve technical efficiency of forest product firms by utilizing wood residues to create biomass energy for value-added processing of forest products.
- Reforestation and rehabilitation of mangrove forests should be encouraged to recapture the environmental services that they provide.
- Alternative fuel sources and tree plantations should be promoted to alleviate energy consumption pressures.
- National laws and policies need to be developed to better address the protection of existing mangrove forests.

D. Exploitation of Species for Wildlife Trade, Overfishing, and Other Illegal/Illicit Exploitation of Natural Resources

- Continue to bring together representatives from across Madagascar — from government, civil society, the private sector, and the donor community — to strengthen commitment to fight against illegal exploitation of natural resources at all levels. The goal must be to define how national, regional, and local government authorities can respond in a more efficient and timely manner to problems of illegal and illicit exploitation, deforestation, and unregulated mining exploitation and commercialization.
- Facilitate the passage of an anti-corruption law.
- Help develop regional forest/mining observatories (i.e., independent monitoring bodies).

- Support improved governance of the fisheries sector — governance issues here are in many respects analogous to those of the forest sector.
- Help establish community-based natural resource management and integrated coastal area management in densely populated coastal areas, applying an integrated coastal/river-basin approach.
- Enforce legal texts such as the MECIE decree that requires that all fishing exploitation comply with environmental impact assessment provisions.
- Improve forest sector governance, especially institutional development within the Ministry of Water and Forests — USAID will continue to play a lead role here.
- Freshwater fish farming and marine DCP techniques should be promoted with education on endangered species.
- CITES enforcement and regulation can be developed through institutional capacity building at national and regional levels.
- This should be complemented by national laws and policies that address more environmentally friendly practices, especially in marine areas.
- Behavioral change away from traditional practices to ecosystem holistic ones and alternative livelihoods should be encouraged at all levels.

E. Increases in Mining Operations

- Improve and help enforce mining legislation.
- Policies and laws should be revisited such as the MECIE regarding smaller mining operations.
- Help enforce legal texts such as the MECIE decree (99-954, dated December 1999) that requires that all mining comply with environmental impact assessment provisions.
- Help establish transparent grading and sales mechanisms to reduce clandestine trade of precious and semi-precious stones.
- Strengthen the capacity of MinEnvEFT with regard to mining permit reviews, environmental impact assessments, and regional management plan elaboration;
- Inter-ministry coordination and collaboration should continue to be facilitated; the mining Arreté for October 2008 needs to be extended.

F. Sedimentation form Soil Erosion

- Help introduce soil conservation practices, especially on upland areas draining into the lower reaches of the larger rivers.
- Help establish community-based natural resource management and integrated coastal area management in densely populated coastal areas, applying an integrated coastal/river-basin approach.
- Support tree nurseries, reforestation projects, and tree plantations to counter deforestation.
- Disseminate better agricultural practices and soil conservation techniques.
- The importance of wetland conservation and watershed protection should be spread through complementary and integrated educational programs.

G. Climate Change

- Madagascar should actively promote and participate in carbon sequestration trading projects.
- Adaptation measures can be explored in more vulnerable areas to prepare for climate change.
- Adopt aggressive initiatives to plant trees.

H. Inefficient and Traditional Agriculture

- Agricultural intensification techniques should be promoted to increase productivity and decrease agricultural expansion.
- The education of communities in holistic ecosystem approaches should be supported to further raise awareness of populations of the relationship and integration of surrounding ecosystems and agriculture.

I. Lack of Institutional Capacity

- Capacity building at both central and regional levels should be pursued especially related to the new protected areas.
- ANGAP, the National Office on the Environment (ONE), and MEEFT would greatly benefit from continued training in ecological monitoring, protected area management, policy reform and implementation, and sustainable financing.
- Increased collaboration and coordination should be encouraged to facilitate implementation and monitoring for processes like chain of custody.
- Education reform to achieve certification and adherence to international standards should be sought.

J. Weak Market Infrastructure and Linkages

- Communication between communities through radio and transport needs to be increased to encourage trade.
- Internal and external markets need to be identified and connected to communities to increase market size.
- Infrastructure development and maintenance should be supported to encourage trade and tourism.
- Improve communication and transport infrastructure to reduce transaction costs and allow better integration into the market.
- Secure land tenure needs to be established to promote investment.
- Reinforce land tenure legislation to help improve the land tenure system.
- Full agricultural support should be provided to farmers to aid development.

VII. CURRENT USAID INTERVENTIONS TO CONSERVE TROPICAL FORESTS AND BIODIVERSITY

Since the launch of the NEAP in 1990, USAID has contributed to significant progress in biodiversity and forest conservation in Madagascar. During Phase I of NEAP, USAID played a lead role in supporting biodiversity conservation, forest management, environmental policy development, and institutional strengthening. During NEAP's second phase, USAID helped to expand conservation and development beyond the protected area network, i.e., to larger

landscapes or eco-regions that contained threatened ecosystems. Since then, and with the new 2007 Madagascar Action Plan, eco-regional planning has been recognized as an efficient tool to use within an integrated approach to environmental conservation and economic development.

USAID's support in this sector reinforces Madagascar's capacity to develop and manage its protected areas network; increases local participation in natural resources management; encourages adoption of sustainable agricultural technologies; increases ecotourism and private sectors' involvement in conservation enterprises; and establishes and enables conditions and mechanisms for sustainable environmental agencies.

USAID's support has also reduced human pressure on forests and created economic and social incentives for biodiversity conservation. Analysis of preliminary data suggests that annual forest loss decreased in two priority conservation zones where USAID has worked for the last decade. USAID has been the lead donor in establishing Madagascar's National Park System. As a result, more than 8 percent of Madagascar is now protected (versus 4.7 percent pre-NEAP), with 15 of 16 critical habitats in the protected area network. More protected areas likely will be formally designated this year and in the years to come. USAID has promoted the wise use of resources. At the same time, it has helped link conservation to sustainable small farm agriculture and increased rural family income. Around 380 villages in priority conservation zones are using community-based conservation techniques. USAID support has also encouraged integration of environmental concerns into national, regional, and local planning and policy-making.

VIII. INTEGRATED STRATEGIC PLAN OPPORTUNITIES TO CONSERVE TROPICAL FOREST AND BIODIVERSITY

Under USAID/Madagascar's Integrated Strategic Plan (ISP) for FY 2003-2008, the Mission's overall goal has been "Sustainable and Inclusive Economic Development." Four strategic objectives were developed under the plan:

SO 4: Governance in Targeted Areas Improved (Democracy and Governance, or "DG");

SO 5: Use of Selected Health Services and Products Increased and Practices Improved (Health, Population and Nutrition, or "HPN");

SO 6: Biologically Diverse Forest Ecosystems Conserved (Environment and Rural Development, or "Env/RD"); and

SO 7: Critical Private Markets Expanded (Madagascar Agriculture and Trade, or "MAT").

Additional crosscutting concerns, integrated throughout the Mission portfolio, include good governance, food security, HIV/AIDS prevention and management, conflict and disaster vulnerability, information and communications technology (ICT), gender equity, and public-private alliances. In 2006, due to budget cuts, USAID has been forced to focus on SO 5 and 6, and integrate other objectives as SO 5 and 6 project design and implementation allow.

Among the four strategic objectives, the Env/RD SO directly addresses many of the recommended actions necessary to conserve tropical forests and biodiversity in Madagascar. Other SOs indirectly affect this conservation mandate. Therefore, much of the discussion to

follow focuses on SO 6, Env/RD, and on potential linkages and collaborative efforts between Env/RD and the other SOs.

A. Slash and Burn Agriculture

Env/RD intends to help reduce slash and burn agriculture through interventions centered around communities. Activities will focus on improving forest management incentives and increasing farmer incomes to create stronger economic, ecological, social, and geographical linkages — especially between rural development and reduction of pressure on forest and biodiversity. MAT's IR 1: "Improved Agricultural Production and Practices" and IR 2: "Increased Agribusiness Efficiency" will complement and reinforce Env/RD in this effort.

B. Population Pressure

Madagascar's rapid population growth, and its effect on biodiversity, creates an opportunity for Env/RD and HPN to work together. The underlying principle of this collaboration will be that an integrated population/environment approach — under Env/RD's IR 3: "Demand and Availability of Family Planning and Health Services, Products, and Practices in Priority Conservation Areas Increased" — will help lead to a slowing in the high population growth rates. This will, in turn, help reduce pressures on the natural resources base.

C. Energy Needs, Logging, and Mangrove Deforestation

Env/RD's IR 4: "Increase Investment Initiatives and Partnerships in Natural Resource Management" and IR 5: "Improve Environmental Governance" will provide opportunities for the Mission to promote a sustainable use of resources that will maintain the integrity of remaining primary forests. Legal commercial logging in non-primary forest areas will be supported by the MAT's IR 3: "Increased Trade Flows in Selected Commodities."

D. Exploitation of Species for the Wildlife Trade, Overfishing, and Other Illegal/Illicit Exploitation of Natural Resources

Env/RD and DG will work together to tackle the issues of illegal exploitation in the mining and forest sectors. Env/RD and DG will work to create a transparent mechanism for the flow of information from the field regarding these illegal activities.

Although no specific SO or IR addresses this threat, USAID has considerable experience and a comparative advantage in leveraging funds among other donors such as UNDP and the World Bank.

Env/RD's IR 1: "Improve Forest Management System" and IR 5: "Improve Environmental Governance" were designed to enhance law enforcement and help control corruption. Given the importance of good governance to sustainable environmental management, a close partnership will be established in this area between Env/RD and DG. DG expertise and skills can facilitate training to environment partners to help them play a more effective role in good governance of natural resources.

E. Increases in Mining Operations

Threats from mining exploitation will be addressed under Env/RD's IR 5: "Improve Environmental Governance" and MAT's IR 3: "Increased Trade Flows in Selected Commodities."

F. Sedimentation from Soil Erosion

Env/RD IR's 1,2,3, and 4 are designed to improve water quality for human consumption, agriculture, and fisheries. Water quality will be promoted through stabilization of soils and vegetation cover.

G. Climate Change

There are opportunities through Env/RD to promote carbon sequestration trading and support monitoring of vulnerable ecosystems for effects of climate change.

H. Inefficient and Traditional Agriculture

Improving agricultural productivity and promoting land tenure may be part of the "Selected Policy, Regulatory, and Procedural Changes" to be addressed under MAT's IR 4. Env/RD's IR 3 will also address the land tenure issue through its focus on improved community-based natural resources management. GELOSE — the law promoting management transfer of renewable natural resources to local communities — will be supported and its use promoted. Env/RD will also work with DG — in a collaborative effort with MAT — in this area.

I. Lack of Institutional Capacity

There is continued opportunity through Env/RD to promote and improve MEEFT and agency capacity building and training at the national, regional, and local levels.

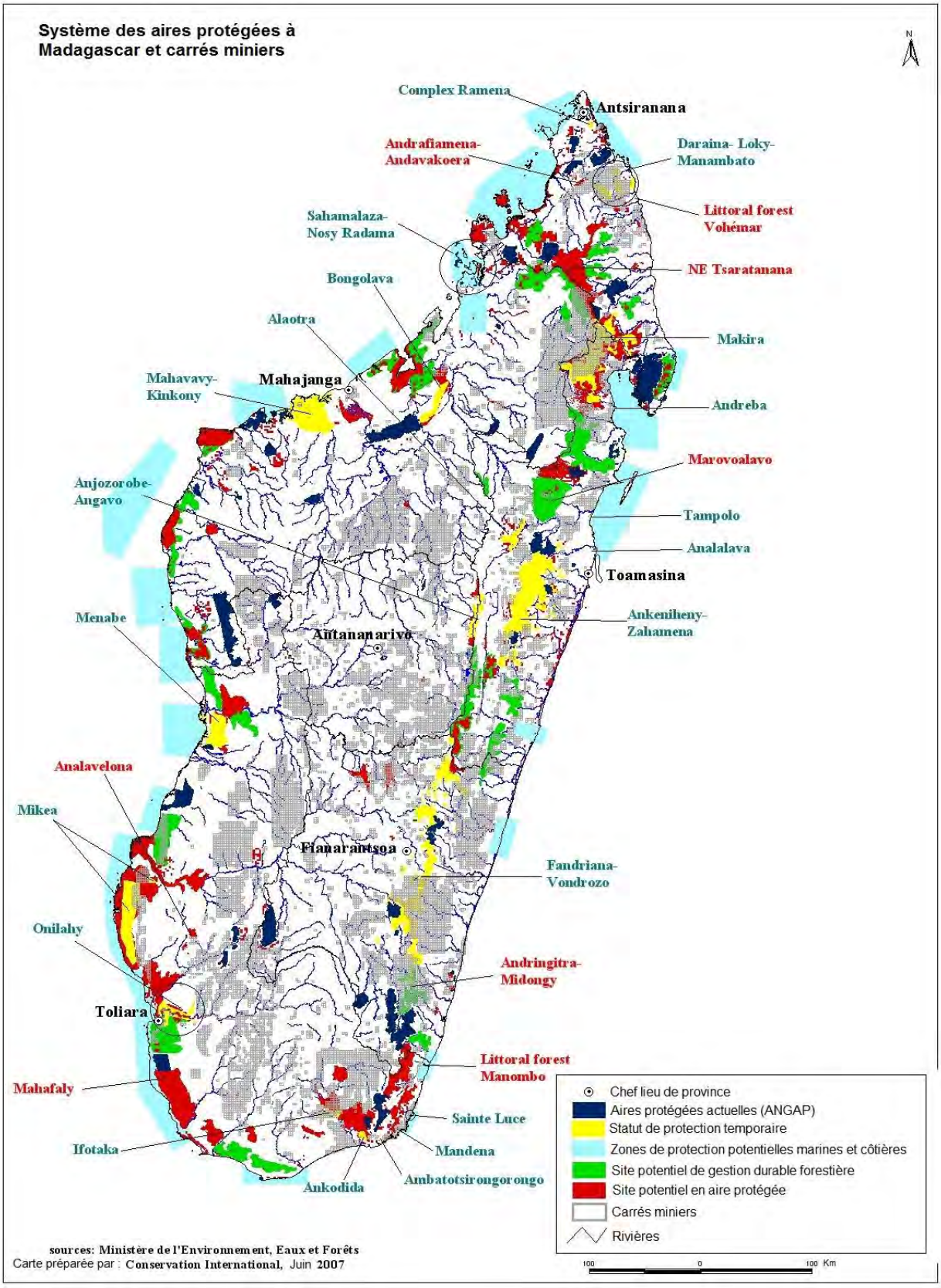
J. Weak Market Infrastructure and Linkages

There is opportunity through Env/RD to improve education, communication, and development of small-scale agriculture and natural resource trade and business.

IX. CONCLUSION

This annex consists of a summary and synthesis of the findings and recommendations of the Environmental Threats and Opportunities Assessment conducted in February 2008 for USAID/Madagascar. The ETOA showed that threats to tropical forests and to biodiversity in Madagascar are closely inter-related, and opportunities to address them should not be treated separately.

Figure 1: Current protected areas, provisional protected areas, potential protected areas, and exploratory mine permit locations in Madagascar



ANNEX D

BIOGRAPHIES OF THE TEAM MEMBERS FOR THE 2008 USAID ETOA UPDATE

Marc Bosch. Mr. Bosch has extensive experience in doing conservation evaluations, policy formulation, and program and project implementation, particularly those that have involved endangered species and their habitats. With wildlife management degrees from Michigan State University, he worked as a Peace Corps Volunteer in wildlife and protected area management in Iran and at the College of Wildlife Management in Garoua, Cameroon. He has also worked on development and environmental projects in Senegal, Afghanistan, and in central African countries. Mr. Bosch is currently the National Endangered Species Program Leader for the U.S. Forest Service. He has worked on integrating endangered species conservation and recovery programs and projects with other natural resource management objectives in Colorado, Puerto Rico, Georgia, and elsewhere in the U.S. National Forest System.

Dr. Steve Dennison. Dr. Dennison has more than 30 years of experience in evaluations, project management, and natural resources conservation and protection in Southeast Asia, Central and South Asia, Africa, North America, the Caribbean, and Eastern Europe. He has been the team leader for this ETOA update and has served in a similar capacity on seven other evaluations and assessments, including four multi-disciplinary teams for USAID projects in the Central Asian Republics, Madagascar, Nigeria, and the Philippines. He has also served as a team member on almost a dozen others. Dr. Dennison has been directly responsible for managing long-term USAID contracts and projects for other donors. The majority of his technical assignments have focused on protected area planning and assistance to local community groups and institutions that rely on natural resources and sustainable conservation practices for their livelihood and economic well-being.

Mananjo Jonahson. Mrs. Jonahson is a marine and environmental scientist with advanced degrees from different countries. For almost a decade she has worked to help her country and the world recognize the fragility and importance of Madagascar's marine and coastal biodiversity. Mrs. Jonahson has expertise in marine species identification, protected area design and monitoring, wildlife radio-telemetry, international conventions, fisheries management and coastal zone management. She worked for five years with the Wildlife Conservation Society in Madagascar as a marine conservation project scientist. She is currently studying the behavior of the lake sturgeon in Lake Ontario, an endangered species native to the North American Great Lakes.

Jason Ko. Mr. Ko is an international development professional with seven years of experience in project management, biodiversity, and forestry results monitoring and reporting, and rural community development. He has worked with diverse partners including: USAID, WWF, WCS, Conservation International, U.S. Forestry Service, and various private organizations. He has extensive experience in research and analysis on the relationship and linkages between development and the environment. Mr. Ko has a strong background in business development, rural community organization and mobilization, and policy analysis.

Voahangy Rajoharison. Mrs. Rajoharison has more than 10 years of experience in development and environmental projects and programs in Madagascar with a focus on environmental impact assessment (EIA) and ecotourism strategies. The majority of these activities have been funded by USAID. She has worked at national, regional, and local levels as well as supported private sector initiatives, especially those engaged in ecotourism enterprises. For the last five years, Mrs. Rajoharison has been a freelance consultant. She has participated in numerous environmental and rural development studies, national and regional workshops aimed at tourism, rural development master plans, project activities that required EIAs and other reviews that examined the impacts of activities on natural resources and biodiversity.

ANNEX E

Persons Consulted/Interviewed

Date	Name	Organization/Institution
27 Jan	Timothy Resch	USAID Africa Bureau Environmental Advisor (via telcom)
31 Jan	Lisa Gaylord	USAID/Madagascar, SO6 (via telcom)
4 Feb	Josoa Razafindretsa	USAID/Madagascar, MEO
	Tiana Razafimahatratra	USAID/Madagascar, PA Specialist
	Joel Andriamahenina	BAMEX
5 Feb	Simon Rafanomezantsoa	WWF, Madagascar
	Verosoa Raharivelo	WWF, Madagascar
6 Feb	Steven Dickinson	Golder Assoc./ Sherritt, Ambatovy
	Aristide Andrianarimisa	WCS at Sherritt, Ambatovy
	Justin Andrianaivoarimanga	ADRA, Moramanga
	James MacKinnon	Conservation International, Technical Director
7 Feb	Tom Erdmann	ERI, Regional Coordinator - Tamatave
8 Feb	Andrew Cooke	Resolve Consulting, Director
	Andrew Keck	Jariala, Eaux et Forêts, Chef de Projet
	Christian Burren	Jariala, Eaux et Forêts, Forestry Specialist
	Martin Nicoll	WWF Madagascar, Senior Advisor
	Anitry Ny Aina Ratsifandrihamanana	WWF Madagascar, Acting Director
10 Feb	Raymond Beloson	Koloharena, Pdt. Antenne Generale, Kéliliana
	Radavy	Vice President, Koloharena, Kéliliana
	Angeline Ramiliarison	Technical Assistant, Koloharena, Kéliliana
	Justin	President, AUE, Koloharena, Kéliliana
	Lehita	Notable, Koloharena, Kéliliana
11 Feb	Mark Freudenberger	ERI Regional Coordinator - Fianarantsoa
	Bakomirina Rasoamananjara	Jariala
	Vololoniaiane Raharinorenjanasoa	ERI - Fianarantsoa
	Jean Sylvain Amdriarmalala	CMP- Fianarantsoa

Date	Name	Organization/Institution
	Jacky Ralaiarivony	WWF- Fianarantsoa
	Haja Guy Randrianarisoa	ERI - Fianarantsoa
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13 Feb	Laurent Guy Rakotondranony	Eaux et Forêts, Directeur Général
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	Laurette Rasoavahiny	Eaux et Forêts, Directeur, SAPM
	Eric Rabenasolo	Eaux et Forêts, Directeur Etudes
	Désiré Randriamasimanana	Eaux et Forêts, Directeur Suivi Ecologique
	Claudine Ramiarison	SAGE, Directeur Executif
	Henri Céléstin	SAGE, Coordonnateur Technique
	Vernier Randriamisaina	SAGE, Coordonnateur Programme PNUD
14 Feb	Barbara Dickerson	USAID/Madagascar, Acting Mission Dir.
	Christian Camara	Missouri Botanical Garden, Perm.Rep.
	Chris Birkinshaw	Missouri Botanical Garden, Ecologist
	Jean Chrysostome Rakotoary	ONE, Directeur Général
	Jean Robert Rakotoarijaona	ONE, Dir. Info Environnementales
15 Feb	Guy Larin	QMM, VP and Resident Director
	Manon Vincelette	QMM, Environmental Specialist
	Jennifer Talbot	Jariala, Regional Representative
	Nosy Ranalisolofo	WWF - Toliara
	Jocelyn Rakotomanana	ANGAP, PNM - Toliara
	Volanirina Ramahery	WWF - Toliara
	Jocelyne Rasoanirina	SAGE - Toliara
	Bernardin Rasolonandrasana	WWF - Toliara, Spiny Forest Ecoregion – Program Coordinator
	Rijasoa Fanazava	WCS - Toliara
16 Feb.	Simon Rakoto	Androy Region SG
	Bedé Mahalatsa	Androy Region DDR
	Flavien Rebara	WWF
	Jean Claude Limberaza	PNM ANGAP, Cap Ste. Marie

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	Victor Razaka	CIREEF
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	Jean Philiber Valae	Association Satraha
	Armand Kamosa	CGGF Ambovombe
	Evelyne R. Rejo	Directeur, DRDR
	Miha	Androy Te-Hana
	Francine Liasoa	Association Ampele Mitraoke
16 Feb	Randrianilavovotra Monjalambo	RT/GTDR
	Simon Ledlelide	Sitrana
	Modeste Fanjaria	Association TAMIFA
	Monja Rafemandrasana P.	ANGAP AML
	Jaona Ranaivoson	Collaborateur, CIREEF - Androy
	Nivomboahangy Rajoharison	Consultante USAID, Ft. Dauphin
	Remeny	2nd V.P Assoc. Fimimano-Anakao
	Thierry Andriamampionona	ANGAP, Agent du Parc - Anakao
	Velonjara Sonina	WWF, Socio-organisateur - Anakao
	Eulalie Tanteliniony	WWF, Socio-organisateur, - Beheloke
	Didi Martial	ANGAP Anakao, Chef de Volet Conservation
	Régis Randrianandrasana	SAGE, Animateur de Zone
17 Feb	Pierre Jules Rakotomalaza	WWF, Botaniste - Toliara
	Martin Nicoll	WWF, Senior Advisor
	Tang Tatianna Christiane	CARE/VARI
	Jhon Jeffrie Ranamana	CARE/VARI
18 Feb	Jean-Marie Sibomana	Jariala, Private Sector Coordinator
	Richard Paper	Mangily, Dive Shop Owner/Operator
	Christian Ralijaona	IHSM - Toliara, V.P. Univ. Toliara
	Mara Edouard Ramanevy	IHSM - Toliara
20 Feb	Glenn Lines	MCC, Country Director
	Eddy Rakotomalala	MCA, Deputy Managing Director
	Lisa Gaylord	USAID SO6 Team Leader

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	Lanto Andriamampianina	WCS, Terrestrial Program Director
	Nicolas Blondel	WCS, Masoala NP Technical Advisor
21 Feb	Charles Rakotondrainibe	ANGAP, Directeur Général Adjoint
	Herijaona Randriamanantenasoa	ANGAP, Directeur des Opérations
	Anselme Rakotomanana	BAMEX, National Coordinator
4 Mar	Klaus Mersmann	GTZ, PGDRN Program Director
	Pascal Lopez	GTZ, Technical Advisor, Sector Policy
	Victor Solo Rakotonirina	GTZ, PGDRN
	Ute Nuber	GTZ, Technical Advisor

SECTION F

IUCN Threatened Animal and Plant Species in Madagascar

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Animal Species							
Acrantophis Dumerili	VU	Boidae	Squamata	Reptilia	Chordata	Dumeril's Boa, Madagascar Ground Boa	Boa de Dumeril, Boa des Savanes de Dumeril
Acrantophis Madagascariensis	VU	Boidae	Squamata	Reptilia	Chordata	Madagascar Boa, Malagasy Ground Boa	Boa de Madagascar, Boa des Savanes de Madagascar
Adetomyrma Venatrix	CR	Formicidae	Hymenoptera	Insecta	Arthropoda		
Afrogyrus Starmuehlneri	EN	Planorbidae	Basommatophora	Gastropoda	Mollusca		
Allocebus Trichotis	EN	Cheirogaleidae	Primates	Mammalia	Chordata	Hairy-Eared Dwarf Lemur	Allocèbe, Chirogale aux Oreilles Poilues
Amauris Nossima	VU	Danaidae	Lepidoptera	Insecta	Arthropoda	Madagascan Friar	
Amaurornis Olivieri	EN	Rallidae	Gruiformes	Aves	Chordata	Sakalava Rail	
Ampelita Julii	EN	Acavidae	Stylommatophora	Gastropoda	Mollusca		
Ampelita Soulaiana	VU	Acavidae	Stylommatophora	Gastropoda	Mollusca		
Ampelita Fulgurata	EN	Acavidae	Stylommatophora	Gastropoda	Mollusca		
Anas Bernieri	EN	Anatidae	Anseriformes	Aves	Chordata	Madagascar Teal	Canard de Bernier, Sarcelle de Bernier, Sarcelle de Madagascar, Sarcelle Malgache de Bernier
Anas Melleri	EN	Anatidae	Anseriformes	Aves	Chordata	Meller's Duck	
Ardea Humbloti	EN	Ardeidae	Ciconiiformes	Aves	Chordata	Madagascar Heron	
Ardeola Idae	EN	Ardeidae	Ciconiiformes	Aves	Chordata	Madagascar Pond-Heron	
Astacoides Crosnieri	EN	Parastacidae	Decapoda	Crustacea	Arthropoda		
Astacoides Petiti	EN	Parastacidae	Decapoda	Crustacea	Arthropoda		
Avahi Occidentalis	VU	Indridae	Primates	Mammalia	Chordata	Western Woolly Lemur	
Aythya Innotata	CR	Anatidae	Anseriformes	Aves	Chordata	Madagascar Pochard	
Balaenoptera Physalus	EN	Balaenopteridae	Cetacea	Mammalia	Chordata	Common Rorqual, Fin Whale, Fin-Backed Whale, Finback,	Baleine Fin, Baleine à Nageoires, Baleinoptère

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
						Finner, Herring Whale, Razorback	Commune, Rorqual Commun
Bedotia Geayi	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata	Zona	
Bedotia Tricolor	CR	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Brachypteracias Leptosomus	VU	Brachypteraciidae	Coraciiformes	Aves	Chordata	Short-Legged Ground-Roller	
Brookesia Perarmata	VU	Chamaeleonidae	Squamata	Reptilia	Chordata	Antsingy Leaf Chameleon	
Carcharias Taurus	VU	Odontaspididae	Lamniformes	Chondrichthyes	Chordata	Grey Nurse Shark, Sand Tiger Shark, Spotted Ragged-Tooth Shark	Requin Taureau
Carcharodon Carcharias	VU	Lamnidae	Lamniformes	Chondrichthyes	Chordata	Great White Shark	
Caretta Caretta	EN	Cheloniidae	Testudines	Reptilia	Chordata	Loggerhead	Caouanne, Tortue Caouanne
Charadrius Thoracicus	VU	Charadriidae	Charadriiformes	Aves	Chordata	Madagascar Plover	
Cheilinus Undulatus	EN	Labridae	Perciformes	Actinopterygii	Chordata	Giant Wrasse, Humphead Wrasse, Humphead, Maori Wrasse, Napoleon Wrasse, Truck Wrasse, Undulate Wrasse	Napoleon
Chelonia Mydas	EN	Cheloniidae	Testudines	Reptilia	Chordata	Green Turtle	Tortue Comestible, Tortue Franche, Tortue Verte
Clavator Moreleti	VU	Acavidae	Stylommatophora	Gastropoda	Mollusca		
Cryptoprocta Ferox	EN	Eupleridae	Carnivora	Mammalia	Chordata	Fossa	Cryptoprocte Féroce, Fossa, Foussa
Daubentonia Madagascariensis	EN	Daubentoniidae	Primates	Mammalia	Chordata	Aye-Aye	Aye-Aye
Diomedea Exulans	VU	Diomedeidae	Procellariiformes	Aves	Chordata	Wandering Albatross	Albatros Hurleur
Dugong Dugon	VU	Dugongidae	Sirenia	Mammalia	Chordata	Dugong, Sea Cow	Dugong
Eliurus Majori	EN	Muridae	Rodentia	Mammalia	Chordata	Major's Tufted-Tailed Rat	
Eliurus Penicillatus	CR	Muridae	Rodentia	Mammalia	Chordata	White-Tipped Tufted-Tailed Rat	
Emballonura Atrata	VU	Emballonuridae	Chiroptera	Mammalia	Chordata	Peters' Sheath-Tailed Bat	
Epinephelus Lanceolatus	VU	Serranidae	Perciformes	Actinopterygii	Chordata	Brindle Bass, Brindled Grouper, Giant Grouper, Queensland Groper	Mérou Lancéolé
Eretmochelys Imbricata	CR	Cheloniidae	Testudines	Reptilia	Chordata	Hawksbill Turtle	Caret, Tortue Caret, Tortue Imbriquée, Tortue à Bec Faucon, Tortue à Écailles
Erymnochelys Madagascariensis	EN	Pelomedusidae	Testudines	Reptilia	Chordata	Madagascar Big-Headed Turtle, Madagascar Sideneck	Podocnémide de Madagascar

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
						Turtle	
Eulemur Coronatus	VU	Lemuridae	Primates	Mammalia	Chordata	Crowned Lemur	Lémur à Couronne
Eulemur Macaco	VU	Lemuridae	Primates	Mammalia	Chordata	Black Lemur	Lémur Macaco, Lémur Noir, Maki Noir
Eulemur Mongoz	VU	Lemuridae	Primates	Mammalia	Chordata	Mongoose Lemur	Lémur Mongoz, Maki Mongoz
Eulemur Rubriventer	VU	Lemuridae	Primates	Mammalia	Chordata	Red-Bellied Lemur	Lémur à Ventre Rouge
Eupleres Goudotii	EN	Eupleridae	Carnivora	Mammalia	Chordata	Falanouc, Fanalouc, Malagasy Mongoose, Slender Fanalouc, Small-Toothed Mongoose	Euplère de Goudot
Euryceros Prevostii	VU	Vangidae	Passeriformes	Aves	Chordata	Helmet Vanga	
Eutriorchis Astur	EN	Accipitridae	Falconiformes	Aves	Chordata	Madagascar Serpent-Eagle	Serpentaire de Madagascar
Fossa Fossana	VU	Eupleridae	Carnivora	Mammalia	Chordata	Fanaloka, Malagasy Civet, Striped Civet	Civette Fossane, Civette Malgache, Fanaloka, Fossana
Furcifer Campani	VU	Chamaeleonidae	Squamata	Reptilia	Chordata		
Furcifer Labordi	VU	Chamaeleonidae	Squamata	Reptilia	Chordata		
Furcifer Minor	VU	Chamaeleonidae	Squamata	Reptilia	Chordata		
Galidictis Fasciata	VU	Eupleridae	Carnivora	Mammalia	Chordata	Broad-Striped Mongoose, Malagasy Broad-Striped Mongoose	
Galidictis Grandidieri	EN	Eupleridae	Carnivora	Mammalia	Chordata	Giant-Striped Mongoose	
Geochelone Gigantea	VU	Testudinidae	Testudines	Reptilia	Chordata	Aldabra Giant Tortoise	Tortue Géante D'aldabra, Tortue Géante
Geochelone Radiata	VU	Testudinidae	Testudines	Reptilia	Chordata	Radiated Tortoise	Tortue Radiée de Madagascar, Tortue Rayonnée
Geochelone Yniphora	EN	Testudinidae	Testudines	Reptilia	Chordata	Angonoka, Madagascar Angulated Tortoise, Madagascar Tortoise	Tortue de Madagascar, Tortue à Plastron Éperonné, Tortue à Soc de Madagascar, Tortue à Éperon
Glossogobius Ankaranensis	VU	Gobiidae	Perciformes	Actinopterygii	Chordata		
Gymnuromys Roberti	VU	Muridae	Rodentia	Mammalia	Chordata	Voalavoanala	
Haliaeetus Vociferoides	CR	Accipitridae	Falconiformes	Aves	Chordata	Madagascar Fish-Eagle	Pygargue de Madagascar
Hapalemur Aureus	CR	Lemuridae	Primates	Mammalia	Chordata	Golden Bamboo Lemur, Golden Lemur	Hapalémur Doré
Hapalemur Simus	CR	Lemuridae	Primates	Mammalia	Chordata	Broad-Nosed Gentle Lemur,	Grand Hapalémur,

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
						Greater Bamboo Lemur	Hapalémur Simien
Hypogeomys Antimena	EN	Muridae	Rodentia	Mammalia	Chordata	Malagasy Giant Rat	
Indri Indri	EN	Indridae	Primates	Mammalia	Chordata	Indri	Indri à Queue Courte, Indri
Lemur Catta	VU	Lemuridae	Primates	Mammalia	Chordata	Ring-Tailed Lemur	Lémur Catta, Maki Catta
Lepidochelys Olivacea	EN	Cheloniidae	Testudines	Reptilia	Chordata	Olive Ridley, Pacific Ridley	Ridley du Pacifique, Tortue Bâtarde, Tortue de Ridley, Tortue Olivâtre
Lepilemur Dorsalis	VU	Megaladapidae	Primates	Mammalia	Chordata	Grey-Backed Sportive Lemur, Nossi-Bé Sportive Lemur	
Lepilemur Septentrionalis	VU	Megaladapidae	Primates	Mammalia	Chordata	Northern Sportive Lemur	
Limnogale Mergulus	VU	Tenrecidae	Afrosoricida	Mammalia	Chordata	Aquatic Tenrec	
Macrotarsomys Ingens	CR	Muridae	Rodentia	Mammalia	Chordata	Greater Big-Footed Mouse	
Mantella Aurantiaca	CR	Mantellidae	Anura	Amphibia	Chordata	Golden Frog, Golden Mantella	Mantelle Dorée
Megaptera Novaeangliae	VU	Balaenopteridae	Cetacea	Mammalia	Chordata	Bunch, Hump Whale, Humpback Whale, Hunchbacked Whale	Baleine à Bosse, Baleine à Taquet, Jubarte, Mégaptère, Rorqual du Cap, Rorqual à Bosse
Mesitornis Unicolor	VU	Mesitornithidae	Gruiformes	Aves	Chordata	Brown Mesite	
Mesocyclops Insulensis	VU	Cyclopidae	Cyclopoida	Crustacea	Arthropoda		
Mesopristes Elongatus	VU	Terapontidae	Perciformes	Actinopterygii	Chordata		
Microcebus Myoxinus	EN	Cheirogaleidae	Primates	Mammalia	Chordata		
Microgale Dryas	VU	Tenrecidae	Afrosoricida	Mammalia	Chordata	Tree Shrew Tenrec	
Mirza Coquereli	VU	Cheirogaleidae	Primates	Mammalia	Chordata	Coquerel's Mouse-Lemur	
Monias Benschi	VU	Mesitornithidae	Gruiformes	Aves	Chordata	Subdesert Mesite	
Mormopterus Jugularis	VU	Molossidae	Chiroptera	Mammalia	Chordata	Peters's Wrinkle-Lipped Bat	
Mungotictis Decemlineata	EN	Eupleridae	Carnivora	Mammalia	Chordata	Malagasy Narrow-Striped Mongoose, Narrow-Striped Mongoose	
Myzopoda Aurita	VU	Myzopodidae	Chiroptera	Mammalia	Chordata	Madagascar Sucker-Footed Bat, Old World Sucker-Footed Bat, Sucker-Footed Bat	
Newtonia Fanovanae	VU	Vangidae	Passeriformes	Aves	Chordata	Red-Tailed Newtonia	
Oriolia Bernieri	VU	Vangidae	Passeriformes	Aves	Chordata	Bernier's Vanga	
Oxylapia Polli	CR	Cichlidae	Perciformes	Actinopterygii	Chordata		

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Pachypanchax Sakaramyi	CR	Aplocheilidae	Cyprinodontiformes	Actinopterygii	Chordata		
Papilio Mangoura	VU	Papilionidae	Lepidoptera	Insecta	Arthropoda		
Paratilapia Polleni	VU	Cichlidae	Perciformes	Actinopterygii	Chordata	Marakely	
Paretroplus Kieneri	VU	Cichlidae	Perciformes	Actinopterygii	Chordata	Kotsovato	
Paretroplus Maculatus	CR	Cichlidae	Perciformes	Actinopterygii	Chordata	Damba Mipentina	
Paretroplus Polyactis	VU	Cichlidae	Perciformes	Actinopterygii	Chordata		
Phelsuma Standingi	VU	Gekkonidae	Squamata	Reptilia	Chordata	Banded Day Gecko, Standing's Day Gecko	Gecko Diurne de Standing, Phelsume de Standing
Propithecus Diadema	EN	Indridae	Primates	Mammalia	Chordata	Diademed Sifaka	Propithèque à Diadème
Propithecus Tattersalli	CR	Indridae	Primates	Mammalia	Chordata	Golden-Crowned Sifaka, Tattersall's Sifaka	
Propithecus Verreauxi	VU	Indridae	Primates	Mammalia	Chordata	Verreaux's Sifaka	Propithèque de Verreaux, Sifaka
Pteropus Rufus	VU	Pteropodidae	Chiroptera	Mammalia	Chordata	Madagascan Flying Fox, Madagascar Flying-Fox, Madagascar Fruit Bat	
Ptychochromoides Betsileanus	CR	Cichlidae	Perciformes	Actinopterygii	Chordata	Trondo Mainty	
Pyxis Arachnoides	VU	Testudinidae	Testudines	Reptilia	Chordata	Spider Tortoise	Pyxide Arachnoide
Pyxis Planicauda	EN	Testudinidae	Testudines	Reptilia	Chordata	Flat-Backed Spider Tortoise, Flat-Shelled Spider Tortoise, Madagascar Flat-Shelled Tortoise	Pyxide à Queue Platte
Rheocles Alaotrensis	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata	Katrana	
Rheocles Wrightae	EN	Bedotiidae	Atheriniformes	Actinopterygii	Chordata	Zona	
Rhincodon Typus	VU	Rhincodontidae	Orectolobiformes	Chondrichthyes	Chordata	Whale Shark	Requin Baleine
Salanoia Concolor	VU	Eupleridae	Carnivora	Mammalia	Chordata	Brown-Tailed Mongoose, Malagasy Brown-Tailed Mongoose, Salano	
Sanzinia Madagascariensis	VU	Boidae	Squamata	Reptilia	Chordata	Madagascar Tree Boa, Sanzinia	Boa des Forits de Madagascar
Sarothrura Watersi	EN	Rallidae	Gruiformes	Aves	Chordata	Slender-Billed Flufftail	
Scotophilus Borbonicus	CR	Vespertilionidae	Chiroptera	Mammalia	Chordata	Lesser Yellow Bat	
Tachybaptus Pelzelnii	VU	Podicipedidae	Podicipediformes	Aves	Chordata	Madagascar Grebe	
Tachybaptus Rufolavatus	CR	Podicipedidae	Podicipediformes	Aves	Chordata	Alaotra Grebe	
Teramulus Waterloti	EN	Atherinidae	Atheriniformes	Actinopterygii	Chordata		
Thunnus Maccoyii	CR	Scombridae	Perciformes	Actinopterygii	Chordata	Southern Bluefin Tuna	

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Thunnus Obesus	VU	Scombridae	Perciformes	Actinopterygii	Chordata	Bigeye Tuna	
Triaenops Furculus	VU	Hipposideridae	Chiroptera	Mammalia	Chordata	Trouessart's Triden Bat	
Tropidophora Deburghiae	EN	Pomatiasidae	Mesogastropoda	Gastropoda	Mollusca		
Typhleotris Madgascarensis	EN	Eleotridae	Perciformes	Actinopterygii	Chordata		
Typhleotris Pauliani	EN	Eleotridae	Perciformes	Actinopterygii	Chordata		
Tyto Soumagnei	EN	Tytonidae	Strigiformes	Aves	Chordata	Madagascar Red Owl	Effraie de Soumagne, Effraie Rousse de Madagascar
Uratelornis Chimaera	VU	Brachypteraciidae	Coraciiformes	Aves	Chordata	Long-Tailed Ground-Roller	
Varecia Variegata	EN	Lemuridae	Primates	Mammalia	Chordata	Ruffed Lemur	Lémur Vari, Maki Vari
Xenopirostris Damii	EN	Vangidae	Passeriformes	Aves	Chordata	Van Dam's Vanga	
Microgale Monticola	VU	Tenrecidae	Afrosoricida	Mammalia	Chordata		
Centrophorus Granulosus	VU	Centrophoridae	Squaliformes	Chondrichthyes	Chordata	Gulper Shark	Squale-Chagrin Commun
Carcharhinus Longimanus	VU	Carcharhinidae	Carcharhiniformes	Chondrichthyes	Chordata	Oceanic Whitetip Shark, White-Tipped Shark, Whitetip Oceanic Shark, Whitetip Shark	Requin Océanique
Sphyrna Mokarran	EN	Sphyrnidae	Carcharhiniformes	Chondrichthyes	Chordata	Great Hammerhead, Hammerhead Shark, Squat-Headed Hammerhead Shark	Grand Requin-Marteau, Marieau Millet, Poisson Pantouflier, Sorosena
Galidia Elegans	VU	Eupleridae	Carnivora	Mammalia	Chordata	Malagasy Ring-Tailed Mongoose, Ring-Tailed Mongoose	
Microcebus Ravelobensis	EN	Cheirogaleidae	Primates	Mammalia	Chordata	Golden-Brown Mouse Lemur	
Boucardicus Esetrae	EN	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Antiquus	VU	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Delicatus	EN	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Curvifolius	EN	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Victorhernandezi	EN	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Albocinctus	VU	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Divei	EN	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Culminans	EN	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Tridentatus	VU	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Rakotoarisoni	VU	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Boucardicus Simplex	CR	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Fortistriatus	CR	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Mahermanae	EN	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Carylae	EN	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Magnilobatus	EN	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Fidimananai	CR	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Boucardicus Randalanai	EN	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Cyathopoma Randalana	VU	Cyclophoridae	Mesogastropoda	Gastropoda	Mollusca		
Circus Macrosceles	VU	Accipitridae	Falconiformes	Aves	Chordata	Madagascar Harrier	
Procellaria Aequinoctialis	VU	Procellariidae	Procellariiformes	Aves	Chordata	White-Chinned Petrel	Puffin à Menton Blanc
Calicalicus Rufocarpalis	VU	Vangidae	Passeriformes	Aves	Chordata	Red-Shouldered Vanga	
Thalassarche Carteri	EN	Diomedeidae	Procellariiformes	Aves	Chordata	Indian Yellow-Nosed Albatross	
Neodrepanis Hypoxantha	VU	Philepittidae	Passeriformes	Aves	Chordata	Yellow-Bellied Asity	
Pheidole Oculata	VU	Formicidae	Hymenoptera	Insecta	Arthropoda		
Nebrius Ferrugineus	VU	Ginglymostomatidae	Orectolobiformes	Chondrichthyes	Chordata	Tawny Nurse Shark	
Negaprion Acutidens	VU	Carcharhinidae	Carcharhiniformes	Chondrichthyes	Chordata	Sharptooth Lemon Shark	
Hemipristis Elongatus	VU	Hemigaleidae	Carcharhiniformes	Chondrichthyes	Chordata	Fossil Shark, Snaggletooth Shark	Milandre Chicor
Stegostoma Fasciatum	VU	Stegostomidae	Orectolobiformes	Chondrichthyes	Chordata	Leopard Shark, Zebra Shark	
Teinobasis Alluaudi	VU	Coenagrionidae	Odonata	Insecta	Arthropoda	Seychelles Fineliner	
Arius Festinus	EN	Ariidae	Siluriformes	Actinopterygii	Chordata		
Arius Uncinatus	EN	Ariidae	Siluriformes	Actinopterygii	Chordata		
Batrachus Uranoscopus	VU	Batrachoididae	Batrachoidiformes	Actinopterygii	Chordata		
Bedotia Masoala	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Bedotia Marojejy	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Bedotia Sp. Nov. 'Bemarivo'	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Bedotia Sp. Nov. 'Betampona'	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Bedotia Sp. Nov. 'Lazana'	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Bedotia Sp. Nov. 'Mahanara'	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Bedotia Sp. Nov. 'Manombo'	CR	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Bedotia Sp. Nov. 'Nosivola'	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Bedotia Sp. Nov. 'Namorona'	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Bedotia Sp. Nov. 'Sambava'	CR	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Bedotia Sp. Nov. 'Ankavia-Ankavanana'	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Bedotia Sp. Nov. 'Vevembe'	CR	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Pachypanchax Sp. Nov. 'Anjingo'	EN	Aplocheilidae	Cyprinodontiformes	Actinopterygii	Chordata		
Pachypanchax Sp. Nov. 'Betsiboka'	VU	Aplocheilidae	Cyprinodontiformes	Actinopterygii	Chordata		
Pachypanchax Sp. Nov. 'Varatraza'	EN	Aplocheilidae	Cyprinodontiformes	Actinopterygii	Chordata		
Pantanodon Sp. Nov. 'Manombo'	CR	Poeciliidae	Cyprinodontiformes	Actinopterygii	Chordata		
Paratilapia Typus	VU	Cichlidae	Perciformes	Actinopterygii	Chordata		
Paratilapia Sp. Nov. 'Vevembe'	CR	Cichlidae	Perciformes	Actinopterygii	Chordata		
Paretroplus Maromandia	EN	Cichlidae	Perciformes	Actinopterygii	Chordata		
Paretroplus Nourissati	VU	Cichlidae	Perciformes	Actinopterygii	Chordata		
Paretroplus Dambabe	EN	Cichlidae	Perciformes	Actinopterygii	Chordata		
Paretroplus Sp. Nov. 'Sofia'	EN	Cichlidae	Perciformes	Actinopterygii	Chordata		
Paretroplus Sp. Nov. 'Dridri Mena'	VU	Cichlidae	Perciformes	Actinopterygii	Chordata		
Paretroplus Sp. Nov. 'Ventitry'	VU	Cichlidae	Perciformes	Actinopterygii	Chordata		
Ptychochromis Inornatus	EN	Cichlidae	Perciformes	Actinopterygii	Chordata		
Pachypanchax Sp. Nov. 'Talio'	VU	Aplocheilidae	Cyprinodontiformes	Actinopterygii	Chordata		
Ptychochromis Sp. Nov. 'Green Garaka'	EN	Cichlidae	Perciformes	Actinopterygii	Chordata		
Ptychochromis Sp. Nov. 'Garaka'	VU	Cichlidae	Perciformes	Actinopterygii	Chordata		
Ptychochromis Sp. Nov. 'Joba Mena'	CR	Cichlidae	Perciformes	Actinopterygii	Chordata		
Ptychochromoides Vondrozo	CR	Cichlidae	Perciformes	Actinopterygii	Chordata		
Ptychochromoides Katria	VU	Cichlidae	Perciformes	Actinopterygii	Chordata		
Pseudoginglymostoma Brevicaudatum	VU	Ginglymostomatidae	Orectolobiformes	Chondrichthyes	Chordata	Shorttail Nurse Shark	Requin-Nourrice à Queue Courte
Rheocles Derhami	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		
Rheocles Vatosoa	VU	Bedotiidae	Atheriniformes	Actinopterygii	Chordata		

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Brachypteracias Squamiger	VU	Brachypteraciidae	Coraciiformes	Aves	Chordata	Scaly Ground-Roller	
Mesitornis Variegatus	VU	Mesitornithidae	Gruiformes	Aves	Chordata	White-Breasted Mesite	
Bernieria Apperti	VU	Sylviidae	Passeriformes	Aves	Chordata	Appert's Greenbul	
Bernieria Tenebrosa	VU	Sylviidae	Passeriformes	Aves	Chordata	Dusky Greenbul	
Rallus Madagascariensis	VU	Rallidae	Gruiformes	Aves	Chordata	Madagascar Rail	
Glareola Ocularis	VU	Glareolidae	Charadriiformes	Aves	Chordata	Madagascar Pratincole	
Monticola Erythronotus	EN	Muscicapidae	Passeriformes	Aves	Chordata	Amber Mountain Rock-Thrush	
Threskiornis Bernieri	EN	Threskiornithidae	Ciconiiformes	Aves	Chordata	Madagascar Sacred Ibis	
Aglyptodactylus Laticeps	EN	Mantellidae	Anura	Amphibia	Chordata		
Boophis Andreonei	VU	Mantellidae	Anura	Amphibia	Chordata		
Boophis Blommersae	VU	Mantellidae	Anura	Amphibia	Chordata		
Boophis Haematopus	VU	Mantellidae	Anura	Amphibia	Chordata		
Boophis Jaegeri	VU	Mantellidae	Anura	Amphibia	Chordata		
Boophis Williamsi	CR	Mantellidae	Anura	Amphibia	Chordata		
Mantella Bernhardi	EN	Mantellidae	Anura	Amphibia	Chordata	Bernhard's Mantella	
Mantella Cowanii	CR	Mantellidae	Anura	Amphibia	Chordata	Cowan's Mantella	
Mantella Crocea	EN	Mantellidae	Anura	Amphibia	Chordata	Yellow Mantella	
Mantella Expectata	CR	Mantellidae	Anura	Amphibia	Chordata	Blue-Legged Mantella	
Mantella Haraldmeieri	VU	Mantellidae	Anura	Amphibia	Chordata	Haraldmeier's Mantella	
Mantella Madagascariensis	VU	Mantellidae	Anura	Amphibia	Chordata	Madagascan Mantella	
Mantella Milotympanum	CR	Mantellidae	Anura	Amphibia	Chordata	Black-Eared Mantella	
Mantella Pulchra	VU	Mantellidae	Anura	Amphibia	Chordata	Beautiful Mantella	
Mantella Viridis	CR	Mantellidae	Anura	Amphibia	Chordata	Green Mantella	
Mantidactylus Ambohitra	VU	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Brunae	EN	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Corvus	EN	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Elegans	VU	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Guibei	EN	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Horridus	EN	Mantellidae	Anura	Amphibia	Chordata		

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Mantidactylus Klemmeri	VU	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Madecassus	EN	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Massorum	VU	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Microtis	EN	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Microtympanum	EN	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Pauliani	CR	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Rivicola	VU	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Salegy	VU	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Schilfi	VU	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Silvanus	EN	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Striatus	VU	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Tandroka	VU	Mantellidae	Anura	Amphibia	Chordata		
Mantidactylus Webbi	EN	Mantellidae	Anura	Amphibia	Chordata		
Anodonthyla Montana	VU	Microhylidae	Anura	Amphibia	Chordata		
Anodonthyla Rouxae	EN	Microhylidae	Anura	Amphibia	Chordata		
Madecassophryne Truebae	EN	Microhylidae	Anura	Amphibia	Chordata		
Platypelis Alticola	EN	Microhylidae	Anura	Amphibia	Chordata		
Platypelis Mavomavo	EN	Microhylidae	Anura	Amphibia	Chordata		
Platypelis Milloti	EN	Microhylidae	Anura	Amphibia	Chordata		
Platypelis Tetra	EN	Microhylidae	Anura	Amphibia	Chordata		
Platypelis Tsaratananaensis	VU	Microhylidae	Anura	Amphibia	Chordata		
Plethodontohyla Brevipes	EN	Microhylidae	Anura	Amphibia	Chordata		
Plethodontohyla Coronata	VU	Microhylidae	Anura	Amphibia	Chordata		
Plethodontohyla Coudreaui	VU	Microhylidae	Anura	Amphibia	Chordata		
Plethodontohyla Guentherpetersi	EN	Microhylidae	Anura	Amphibia	Chordata		
Plethodontohyla Serratopalpebrosa	VU	Microhylidae	Anura	Amphibia	Chordata		
Plethodontohyla Tuberata	VU	Microhylidae	Anura	Amphibia	Chordata		
Rhombophryne Testudo	VU	Microhylidae	Anura	Amphibia	Chordata		
Scaphiophryne Boribory	EN	Microhylidae	Anura	Amphibia	Chordata		

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Scaphiophryne Gottlebei	CR	Microhylidae	Anura	Amphibia	Chordata		
Scaphiophryne Marmorata	VU	Microhylidae	Anura	Amphibia	Chordata		
Stumpffia Helenae	CR	Microhylidae	Anura	Amphibia	Chordata		
Stumpffia Pygmaea	VU	Microhylidae	Anura	Amphibia	Chordata		
Dipturus Crosnieri	VU	Rajidae	Rajiformes	Chondrichthyes	Chordata	Madagascar Skate	
Rhinoptera Javanica	VU	Rhinopteridae	Rajiformes	Chondrichthyes	Chordata	Flapnose Ray, Javanese Cownose Ray	Mourine Javanaise
Taeniura Meyeni	VU	Dasyatidae	Rajiformes	Chondrichthyes	Chordata	Black-Blotched Stingray, Black-Spotted Stingray, Blotched Fantail Ray, Fantail Stingray, Giant Reef Ray, Round Ribbontail Ray, Speckled Stingray	Pastenague Eventail
Isurus Paucus	VU	Lamnidae	Lamniformes	Chondrichthyes	Chordata	Longfin Mako	Petit Taupe, Taupe Longue Aile
Microgale Jenkinsae	EN	Tenrecidae	Afrosoricida	Mammalia	Chordata		
Microgale Nasoloi	EN	Tenrecidae	Afrosoricida	Mammalia	Chordata	Nasolo's Shrew Tenrec	
Argyrosomus Hololepidotus	EN	Sciaenidae	Perciformes	Actinopterygii	Chordata	Madagascar Kob, Madagascar Meagre	Maigre du Sud
Bolbometopon Muricatum	VU	Scaridae	Perciformes	Actinopterygii	Chordata	Bumphead Parrotfish, Double-Headed Parrotfish, Green Humphead Parrotfish, Humphead Parrotfish	Filambase, Perroquet Bossu Vert, Perroquet à Bosse
Phelsuma Antanosy	CR	Gekkonidae	Squamata	Reptilia	Chordata		
Pseudoxyrhopus Kely	EN	Colubridae	Squamata	Reptilia	Chordata		
IUCN 2007. 2007 IUCN Red List of Threatened Species. WWW.IUCNREDLIST.ORG Downloaded 2 APRIL 2008							
Plant Species							
Adansonia grandidieri	EN	Bombacaceae	Malvales	Magnoliopsida			
Adansonia suarezensis	EN	Bombacaceae	Malvales	Magnoliopsida			
Stuhlmannia moavi	VU	Leguminosae	Fabales	Magnoliopsida			
Intsia bijuga	VU	Leguminosae	Fabales	Magnoliopsida			
Delonix regia	VU	Leguminosae	Fabales	Magnoliopsida			
Chloroxylon swietenia	VU	Rutaceae	Sapindales	Magnoliopsida			
Adansonia perrieri	EN	Bombacaceae	Malvales	Magnoliopsida			

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Prunus africana	VU	Rosaceae	Rosales	Magnoliopsida			
Dalbergia baronii	VU	Leguminosae	Fabales	Magnoliopsida			
Podocarpus rostratus	EN	Podocarpaceae	Coniferales	Coniferopsida			
Podocarpus capuronii	EN	Podocarpaceae	Coniferales	Coniferopsida			
Calophyllum chapelieri	VU	Guttiferae	Theales	Magnoliopsida			
Khaya madagascariensis	EN	Meliaceae	Sapindales	Magnoliopsida			
Cordyla haraka	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia abrahamii	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia humbertii	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia xerophila	EN	Leguminosae	Fabales	Magnoliopsida			
Dicraeopetalum capuroniana	VU	Leguminosae	Fabales	Magnoliopsida			
Dicraeopetalum mahafaliensis	VU	Leguminosae	Fabales	Magnoliopsida			
Erythrina ankaranensis	EN	Leguminosae	Fabales	Magnoliopsida			
Erythrina hazomboay	VU	Leguminosae	Fabales	Magnoliopsida			
Erythrina perrieri	CR	Leguminosae	Fabales	Magnoliopsida			
Millettia nathaliae	EN	Leguminosae	Fabales	Magnoliopsida			
Millettia aurea	EN	Leguminosae	Fabales	Magnoliopsida			
Millettia capuronii	VU	Leguminosae	Fabales	Magnoliopsida			
Millettia hitsika	EN	Leguminosae	Fabales	Magnoliopsida			
Millettia orientalis	EN	Leguminosae	Fabales	Magnoliopsida			
Millettia taolanaroensis	EN	Leguminosae	Fabales	Magnoliopsida			
Neoharmsia baronii	CR	Leguminosae	Fabales	Magnoliopsida			
Neoharmsia madagascariensis	VU	Leguminosae	Fabales	Magnoliopsida			
Ormocarpopsis calcicola	EN	Leguminosae	Fabales	Magnoliopsida			
Ormocarpopsis itremoensis	CR	Leguminosae	Fabales	Magnoliopsida			
Ormocarpopsis mandrarensis	VU	Leguminosae	Fabales	Magnoliopsida			
Ormocarpopsis parvifolia	VU	Leguminosae	Fabales	Magnoliopsida			
Ormocarpopsis tulearensis	EN	Leguminosae	Fabales	Magnoliopsida			
Phylloxylon arenicola	CR	Leguminosae	Fabales	Magnoliopsida			

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Phylloxylon decipiens	EN	Leguminosae	Fabales	Magnoliopsida			
Phylloxylon perrieri	EN	Leguminosae	Fabales	Magnoliopsida			
Phylloxylon phillipsonii	CR	Leguminosae	Fabales	Magnoliopsida			
Phylloxylon spinosa	EN	Leguminosae	Fabales	Magnoliopsida			
Phylloxylon xiphoclada	CR	Leguminosae	Fabales	Magnoliopsida			
Phylloxylon xylophylloides	VU	Leguminosae	Fabales	Magnoliopsida			
Pongamiopsis amygdalina	EN	Leguminosae	Fabales	Magnoliopsida			
Pongamiopsis viguieri	VU	Leguminosae	Fabales	Magnoliopsida			
Sakoanala madagascariensis	EN	Leguminosae	Fabales	Magnoliopsida			
Vaughania cloiselii	VU	Leguminosae	Fabales	Magnoliopsida			
Xanthocercis madagascariensis	VU	Leguminosae	Fabales	Magnoliopsida			
Delonix pumila	EN	Leguminosae	Fabales	Magnoliopsida			
Delonix tomentosa	EN	Leguminosae	Fabales	Magnoliopsida			
Delonix velutina	CR	Leguminosae	Fabales	Magnoliopsida			
Takhtajania perrieri	EN	Winteraceae	Magnoliales	Magnoliopsida			
Dalbergia andapensis	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia aurea	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia bathiei	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia bojeri	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia brachystachya	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia catipenonii	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia capuronii	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia chapelieri	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia chlorocarpa	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia davidii	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia delphinensis	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia erubescens	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia glaberrima	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia glaucocarpa	EN	Leguminosae	Fabales	Magnoliopsida			

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Dalbergia hildebrandtii	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia hirticalyx	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia hutibertii	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia lemurica	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia louvelii	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia madagascariensis	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia maritima	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia monticola	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia neoperrieri	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia normandii	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia orientalis	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia pseudobaronii	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia purpurascens	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia suaresensis	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia tricolor	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia viguieri	VU	Leguminosae	Fabales	Magnoliopsida			
Dalbergia tsaratananensis	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia tsiandalana	EN	Leguminosae	Fabales	Magnoliopsida			
Dalbergia urschii	EN	Leguminosae	Fabales	Magnoliopsida			
Beccariophoenix madagascariensis	CR	Palmae	Arecales	Liliopsida			
Borassus madagascariensis	VU	Palmae	Arecales	Liliopsida			
Borassus sambiranensis	EN	Palmae	Arecales	Liliopsida			
Dypsis ambanjae	CR	Palmae	Arecales	Liliopsida			
Dypsis ampasindavae	EN	Palmae	Arecales	Liliopsida			
Dypsis antanambensis	EN	Palmae	Arecales	Liliopsida			
Dypsis arenarum	CR	Palmae	Arecales	Liliopsida			
Dypsis basilonga	EN	Palmae	Arecales	Liliopsida			
Dypsis bejofo	EN	Palmae	Arecales	Liliopsida			
Dypsis boiviniana	EN	Palmae	Arecales	Liliopsida			

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Dypsis canaliculata	CR	Palmae	Arecales	Liliopsida			
Dypsis canescens	CR	Palmae	Arecales	Liliopsida			
Dypsis ceracea	CR	Palmae	Arecales	Liliopsida			
Dypsis commersoniana	CR	Palmae	Arecales	Liliopsida			
Dypsis coursii	VU	Palmae	Arecales	Liliopsida			
Dypsis decaryi	VU	Palmae	Arecales	Liliopsida			
Dypsis decipiens	EN	Palmae	Arecales	Liliopsida			
Dypsis dransfieldii	EN	Palmae	Arecales	Liliopsida			
Dypsis faneva	EN	Palmae	Arecales	Liliopsida			
Dypsis fasciculata	VU	Palmae	Arecales	Liliopsida			
Dypsis hovomantsina	CR	Palmae	Arecales	Liliopsida			
Dypsis ifanadianae	CR	Palmae	Arecales	Liliopsida			
Dypsis intermedia	CR	Palmae	Arecales	Liliopsida			
Dypsis interrupta	CR	Palmae	Arecales	Liliopsida			
Dypsis ligulata	CR	Palmae	Arecales	Liliopsida			
Dypsis malcomberi	VU	Palmae	Arecales	Liliopsida			
Dypsis mananjarensis	VU	Palmae	Arecales	Liliopsida			
Dypsis mangorensis	CR	Palmae	Arecales	Liliopsida			
Dypsis mcdonaldiana	VU	Palmae	Arecales	Liliopsida			
Dypsis nauseosa	CR	Palmae	Arecales	Liliopsida			
Dypsis nossibensis	CR	Palmae	Arecales	Liliopsida			
Dypsis onilahensis	VU	Palmae	Arecales	Liliopsida			
Dypsis oreophila	VU	Palmae	Arecales	Liliopsida			
Dypsis oropedionis	CR	Palmae	Arecales	Liliopsida			
Dypsis ovobontsira	CR	Palmae	Arecales	Liliopsida			
Dypsis paludosa	VU	Palmae	Arecales	Liliopsida			
Dypsis perrieri	VU	Palmae	Arecales	Liliopsida			
Dypsis pilulifera	VU	Palmae	Arecales	Liliopsida			
Dypsis prestoniana	VU	Palmae	Arecales	Liliopsida			

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Dypsis procera	VU	Palmae	Arecales	Liliopsida			
Dypsis psammophila	CR	Palmae	Arecales	Liliopsida			
Dypsis rivularis	EN	Palmae	Arecales	Liliopsida			
Dypsis sahanofensis	EN	Palmae	Arecales	Liliopsida			
Dypsis saintelucei	CR	Palmae	Arecales	Liliopsida			
Dypsis scottiana	VU	Palmae	Arecales	Liliopsida			
Dypsis serpentina	VU	Palmae	Arecales	Liliopsida			
Dypsis singularis	CR	Palmae	Arecales	Liliopsida			
Dypsis tsaravotsira	EN	Palmae	Arecales	Liliopsida			
Dypsis utilis	VU	Palmae	Arecales	Liliopsida			
Lemurophoenix halleuxii	EN	Palmae	Arecales	Liliopsida			
Marojejya darianii	CR	Palmae	Arecales	Liliopsida			
Marojejya insignis	VU	Palmae	Arecales	Liliopsida			
Masoala kona	EN	Palmae	Arecales	Liliopsida			
Masoala madagascariensis	VU	Palmae	Arecales	Liliopsida			
Orania ravaka	VU	Palmae	Arecales	Liliopsida			
Orania trispatha	CR	Palmae	Arecales	Liliopsida			
Ravenea albicans	EN	Palmae	Arecales	Liliopsida			
Ravenea dransfieldii	VU	Palmae	Arecales	Liliopsida			
Ravenea glauca	VU	Palmae	Arecales	Liliopsida			
Ravenea julietiae	EN	Palmae	Arecales	Liliopsida			
Ravenea krociana	VU	Palmae	Arecales	Liliopsida			
Ravenea lakatra	EN	Palmae	Arecales	Liliopsida			
Ravenea latisecta	EN	Palmae	Arecales	Liliopsida			
Ravenea louvelii	EN	Palmae	Arecales	Liliopsida			
Ravenea musicalis	VU	Palmae	Arecales	Liliopsida			
Ravenea nana	EN	Palmae	Arecales	Liliopsida			
Ravenea rivularis	VU	Palmae	Arecales	Liliopsida			
Ravenea sambiranensis	VU	Palmae	Arecales	Liliopsida			

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Ravenea xerophila	EN	Palmae	Arecales	Liliopsida			
Satranala decussilvae	EN	Palmae	Arecales	Liliopsida			
Voanioala gerardii	CR	Palmae	Arecales	Liliopsida			
Dypsis ambositrae	CR	Palmae	Arecales	Liliopsida			
Aloe helenae	CR	Aloaceae	Liliales	Liliopsida			
Aloe suzannae	CR	Aloaceae	Liliales	Liliopsida			
Bryopteris gaudichaudii	CR	Lejeuneaceae	Jungermanniales	Marchantiopsida			
Caudalejeunea grolleana	EN	Lejeuneaceae	Jungermanniales	Marchantiopsida			
Symbiezidium madagascariensis	EN	Lejeuneaceae	Jungermanniales	Marchantiopsida			
Podocarpus humbertii	EN	Podocarpaceae	Coniferales	Coniferopsida			
Nepenthes madagascariensis	VU	Nepenthaceae	Nepenthales	Magnoliopsida			
Nepenthes masoalensis	EN	Nepenthaceae	Nepenthales	Magnoliopsida			
Podocarpus perrieri	CR	Podocarpaceae	Coniferales	Coniferopsida			
Euphorbia alcicornis	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia alfredii	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia ambarivatoensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia ambovombensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia analalavensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia ankaranae	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia ankarensis	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia ankazobensis	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia annamarieae	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia aureoviridiflora	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia banae	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia beharensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia bemarahaensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia benoistii	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia berorohae	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia biaculeata	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Euphorbia boinensis	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia boissieri	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia boiteaui	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia bongolavensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia bosseri	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia brachyphylla	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia bulbispina	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia capmanambatoensis	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia cap-saintemariensis	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia capuronii	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia cedrorum	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia cremersii	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia croizatii	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia cylindrifolia	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia decaryi	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia decorsei	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia delphinensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia denisiana	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia didiereoides	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia duranii	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia elliotii	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia ensifolia	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia erythroxyloides	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia famatamboay	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia fianarantsoae	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia francoisii	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia geroldii	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia gottlebei	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia grandidieri	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Euphorbia guillauminiana	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia hedyotoides	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia herman-schwartzii	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia hildebrandtii	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia hofstaetteri	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia horombensis	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia humbertii	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia iharanae	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia imerina	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia itremensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia kamponii	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia kondoi	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia labatii	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia leuconeura	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia lophogona	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia mahabobokensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia mahafalensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia mananarensis	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia mandravioky	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia mangelsdorffii	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia mangokyensis	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia mangorensis	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia martinae	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia millotii	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia moratii	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia neohumbertii	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia pachypodioides	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia parvicyathophora	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia paulianii	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Euphorbia pellegrini	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia perrieri	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia pirahazo	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia platyclada	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia primulifolia	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia quartziticola	EN	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia randrianjohanyi	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia rauhii	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia razafindratsirae	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia retrospina	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia robivelonae	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia rossii	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia sakarahaensis	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia salota	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia subpeltatophylla	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia thouarsiana	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia trichophylla	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia tulearensis	CR	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia vezorum	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia waringiae	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Euphorbia zakamenae	VU	Euphorbiaceae	Euphorbiales	Magnoliopsida			
Asteropeia amblyocarpa	CR	Asteropeiaceae	Theales	Magnoliopsida			
Asteropeia labatii	EN	Asteropeiaceae	Theales	Magnoliopsida			
Asteropeia matrambody	EN	Asteropeiaceae	Theales	Magnoliopsida			
Asteropeia mcphersonii	VU	Asteropeiaceae	Theales	Magnoliopsida			
Asteropeia micraster	EN	Asteropeiaceae	Theales	Magnoliopsida			
Asteropeia rhopaloides	EN	Asteropeiaceae	Theales	Magnoliopsida			
Melanophylla angustior	CR	Melanophyllaceae	Cornales	Magnoliopsida			
Melanophylla madagascariensis	VU	Melanophyllaceae	Cornales	Magnoliopsida			

Scientific Name	IUCN Status	Family	Order	Class	Phylum	Common Name	Nom Commun
Melanophylla modestei	EN	Melanophyllaceae	Cornales	Magnoliopsida			
Melanophylla perrieri	CR	Melanophyllaceae	Cornales	Magnoliopsida			
Leptolaena delphinensis	CR	Sarcolaenaceae	Malvales	Magnoliopsida			
Leptolaena abrahamii	EN	Sarcolaenaceae	Malvales	Magnoliopsida			
Leptolaena multiflora	EN	Sarcolaenaceae	Malvales	Magnoliopsida			
Leptolaena pauciflora	EN	Sarcolaenaceae	Malvales	Magnoliopsida			
Leptolaena masoalensis	CR	Sarcolaenaceae	Malvales	Magnoliopsida			
Leptolaena raymondii	CR	Sarcolaenaceae	Malvales	Magnoliopsida			
Sarcolaena delphinensis	EN	Sarcolaenaceae	Malvales	Magnoliopsida			
Sarcolaena grandiflora	CR	Sarcolaenaceae	Malvales	Magnoliopsida			
Sarcolaena humbertiana	CR	Sarcolaenaceae	Malvales	Magnoliopsida			
Sarcolaena isaloensis	CR	Sarcolaenaceae	Malvales	Magnoliopsida			
IUCN 2007. 2007 IUCN Red List of Threatened Species. www.iucnredlist.org Downloaded 2 April 2008							

ANNEX G

MADAGASCAR SPECIES ON CITES APPENDIX I AND II, 2006 (French and Malagasy names are given for some species)

APPENDIX I

FAUNA

(d) All Madagascar LEMURS: Gidro, Hira, Sifaka, Akomba, Babakoto, Simpona, etc
(e) Dugong dugong (Le Dugong): Lambohara, Lambondriaka
(f) Geocheolone radiata (Tortue radiée): Sokatra, Sokaky
(g) Geocheolone yniphora (Tortue à éperon de Madagascar): Angonoka
(h) All CHELONIDAE (Toutes les tortues de mer): Ny Sokadranomasina
(i) Dermochelys coriacea (Tortue luth ou tortue géante)
(j) Pyxis arachnoides (Tortue araignée)
(k) Pyxis planicauda (Pyxide à queue plate): Kapidolo
(l) Acrantophis spp. (Boa de Madagascar): Do
(m) Sanzinia madagascariensis (Boa de Madagascar): Mandotra
(n) Diadema albatros (Albatros a queue courte ou de steller): Vorondranomasina
(o) Falco peregrinus (Faucon pèlerin): Voromahery
(p) Tito soumagnei (Effraie de Madagascar): Torotoroka, Vorondolo
(q) Baleina spp (Baleine)
(r) Dyscophus antongilii (Grenouille rouge d'Antongil)
(s) Brookesia perarmata: Ramilaheloka

FLORA

- Pachypodium ambongense - Pachypodium baronii -Pachypodium decaryi
- Chrysalidocarpus decipiens: Hovotra, Menavozona

- Aloe albiflora	- Aloe baworthioides (2)	- Aloe alfredii
- Aloe helenae	- Aloe bakeri	- Aloe elata (3)
- Aloe bellatula	- Aloe parallelifolia	- Aloe calcairophila
- Aloe parvula	- Aloe compressa (1)	- Aloe versicolor
- Aloe delphinensis	- Aloe rauhii	- Aloe desoingsii

- Aloe suzannae

includes Aloe compressa var. rugosquamosa and Aloe compressa var. schistophila

includes Aloe hawortioides var. aurantiaca
includes Aloe laeta var. maniensis

- Euphorbia ambovombenisis
- Euphorbia cremersii
- Euphorbia cylindrifolia (4)
- Euphorbia decaryi
- Euphorbia françoisii
- Euphorbia moratii
- Euphorbia parvicyathophora
- Euphorbia quartziticola
- Euphorbia tulearensis (5)

includes Euphorbia cylindrifolia spp. Tuberifera
includes Euphorbia capsaintemariensis var. tulearensis

(t) Aerangis elata/Aerangis platyphilla (Autre synomime: Angraecum ellisii, Angraecum dubuyssonii, Aerangis buyssonii, Angrochis ellisii, Aerangis platyphylla, Aerangis ellisii, Aerangis cryptodon)

Note: Export of all fauna and flora species on CITES Appendix I is prohibited except for *scientific purposes* duly authorized by the Scientific Authority and the Madagascar CITES Management Authority.

APPENDIX II

FAUNA

(u) Cryptoprocta ferox (Cryptoprocte ou fosa)

(v) Eupleres goudotii (Eupleres de Goudot): Fanaloka

(w) Fossa fossa (Genette fossane): Tambotsodina

(x) All Phoenicopteridae (tous les Flamants roses): Sama, Samaka

(y) Anas bernieri (Canard de Bernier): Menamolotra

(z) Sarkidiornis melanotos (Canard à bosse)

(aa) All Falconiformes (tous les rapaces diurnes): Voromahery, Hitsikitsika, Ankoay, Firasa, papango, Nindry, Beririnina)

(bb) All Strigiformes (tous les rapaces nocturnes): Tararaka, Vorondolo, Torotoroka

(cc) All pscittaciformes (tous les perroquets et les perruches): Boaza (Boloky), Kiokio (Sarivazo, Karaoka)

(dd) All Testudinidae (toutes les autres tortues de terre): Sokatra an-tany rehetra

(ee) Erimnochelys madagascariensis

(ff) Phelsuma spp (tous les petits lézards): Kitsatsaka, Antsatsaka

(gg) Chamaeleo spp (tous les caméléons): Tana, Tanalahy;

(hh) Latimera chalumae: (Coelacanthe)

(ii) Crocodylus niloticus (Crocodile): Mamba, Voay

(jj) Mantella spp

(kk) Tridacnidae spp (Grands coquillages)

(ll) Requin baleine (Rhincodon Typus)

(mm) Scaphiophryne gottlebei: sahon'orana

(nn) Brookesia spp

(oo) Uroplatus spp

FLORA

(pollens, plantes in vitro)

(pp) All seeds of species on CITES appendices (toutes les graines des espèces annexées à la CITES)

(qq) Pachypodium (all pachypodes other than those listed on Appendix I) : Baobab nain

(rr) All Aloe species (Aloe spp.) other than those listed on Appendix I)

(ss) All Cactaceae, Cactus ou Rhipsalis species

(tt) All Stipes of all species of Cyatheaceae (Fangeons) and tree ferns

(uu) All Cycadaceae species (all Cycas palms)

(vv) All Didieraceae species

(ww) All Dicksoniaceae species

(xx) Ceropegia spp

(yy) All Euphobias (Euphorbia spp.) other than those listed in Appendix I

(zz) All Orchid species

(aaa) Neodypsis decaryi (Palmier trièdre)

(bbb) Prunus africana (Pygeum africanum): Sary, Kotofihy

(ccc) Ravenea rivularis: Gora, Bakaly, Vakaka, Malio

(ddd) Ravenea louveli: Lakamarefo, Siraboto

(eee) Satranala decussilvae: Satranala

(fff) Lemurophoenix halleuxii: hovitra varimena

(ggg) Marojeya darianii: ravimbe

(hhh) Beccariophoenix madagascariensis: manarano, manara, maroala (Andasibe), Sikomba (Antanosy)

(iii) Voanioala gerardii: Voanioala (Betsimisaraka)

Note: Only the Madagascar CITES Management Authority, with the Director of the Water and Forest Service, has the authority to issue and sign the CITES export permits for species listed under this convention.

ANNEX H

ADDITIONAL MAPS

Figure G-1. Madagascar's 22 administrative regions

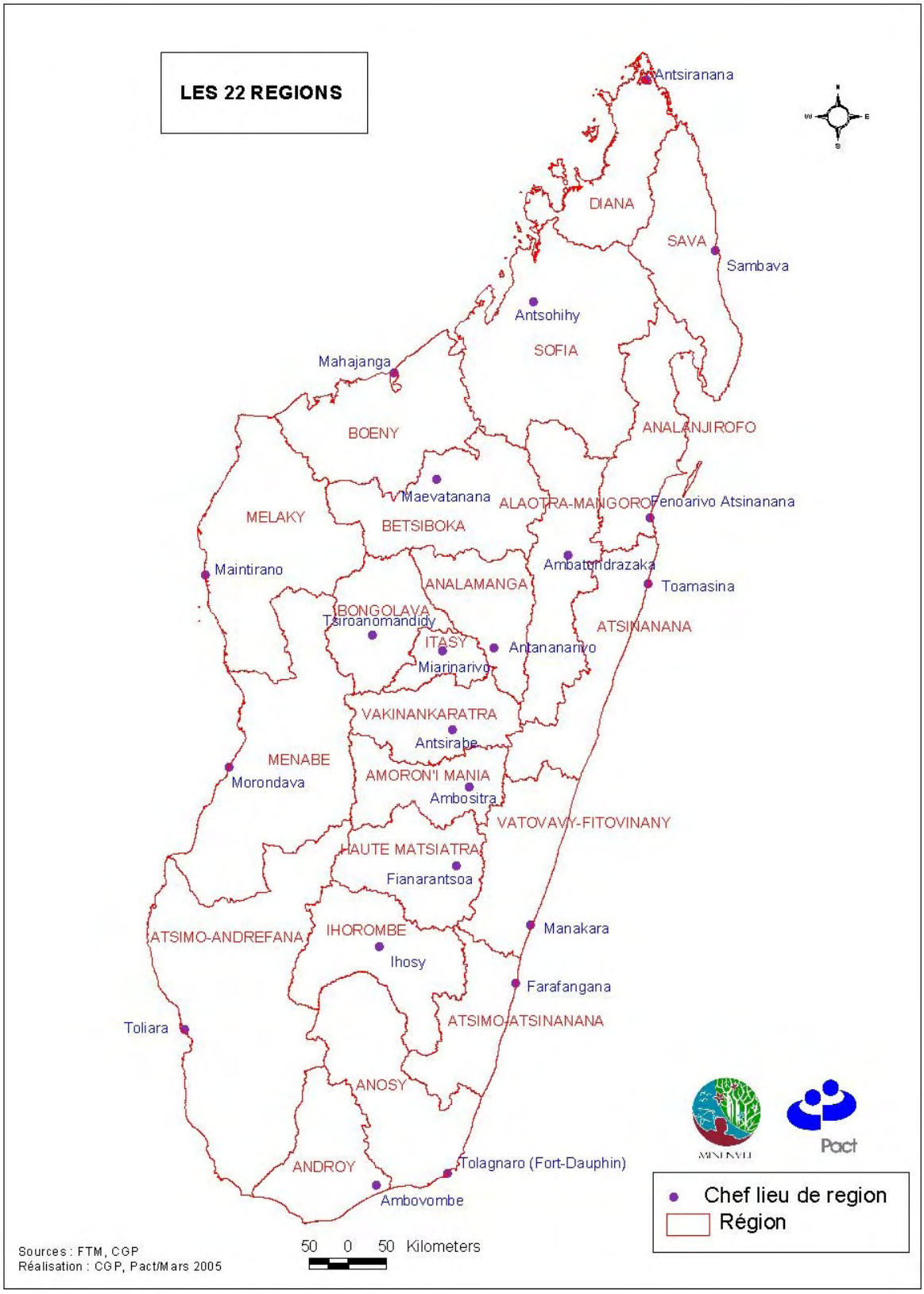


Figure G-2. Actual, planned, and potential protected areas in Madagascar

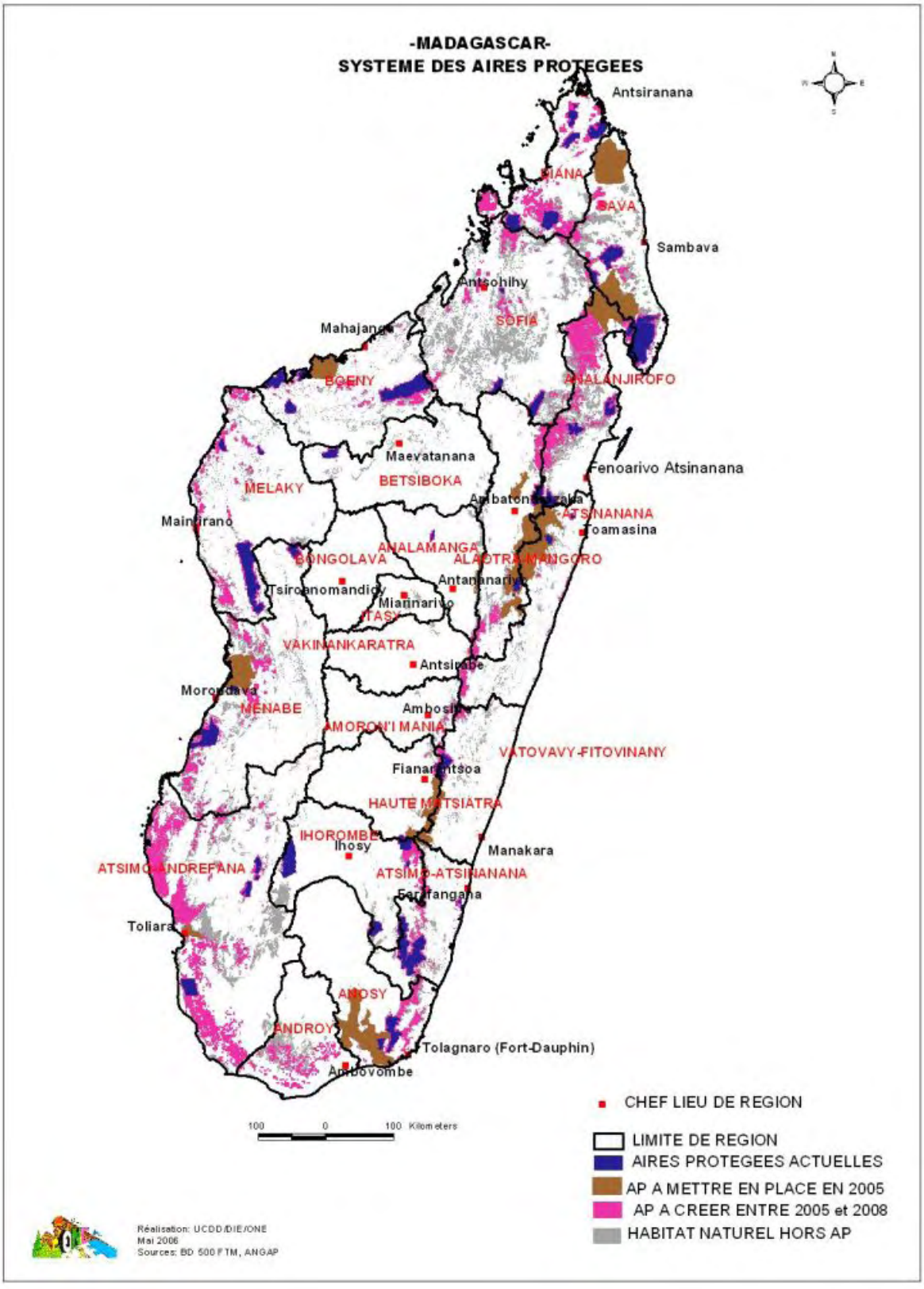


Figure G-3. Current and potential protected areas and forested areas identified for long-term management

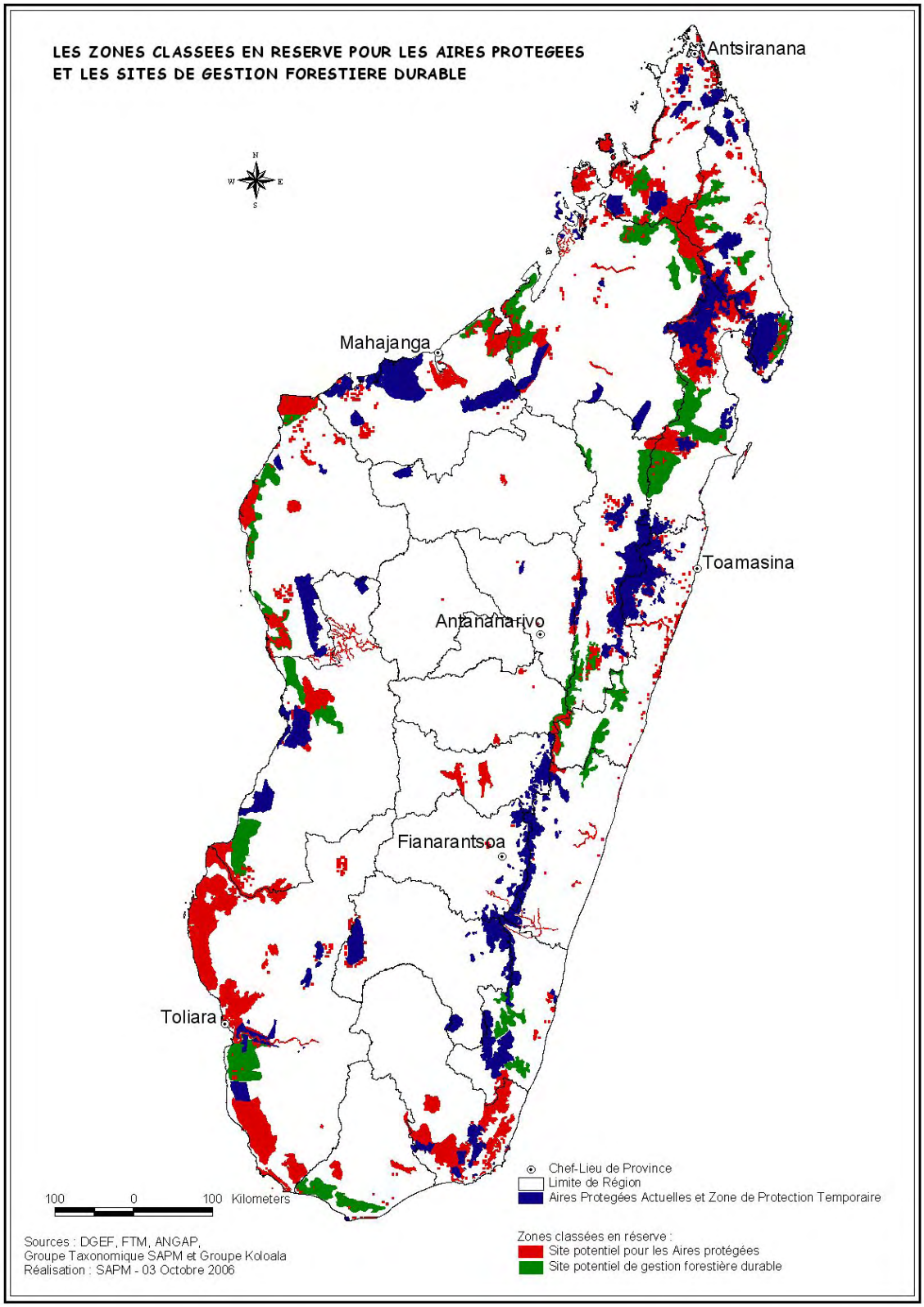


Figure G-4. Forest cover in the Anosy region in southern Madagascar

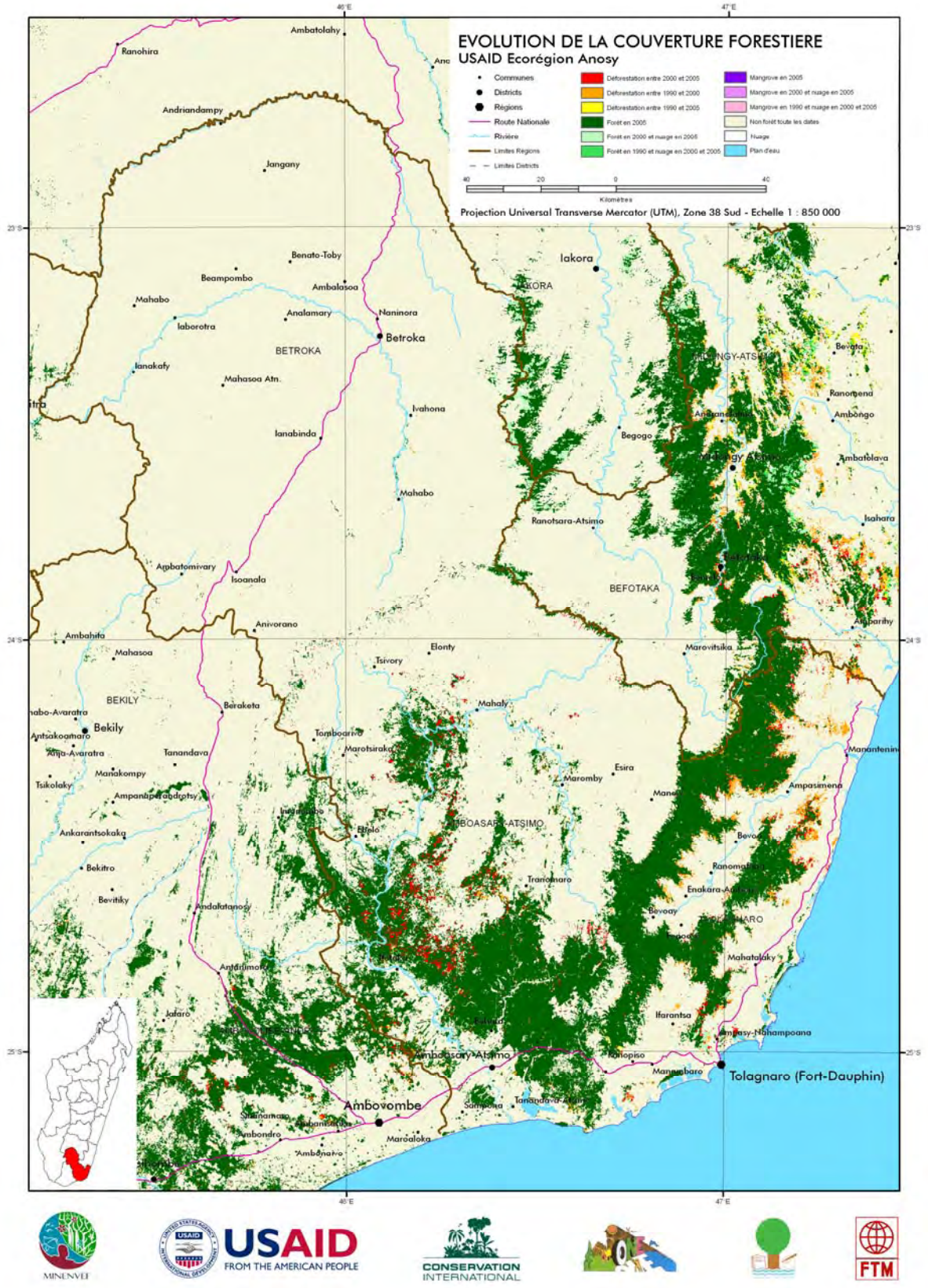


Figure G-5. Reefs, mangroves, and major rivers in Madagascar

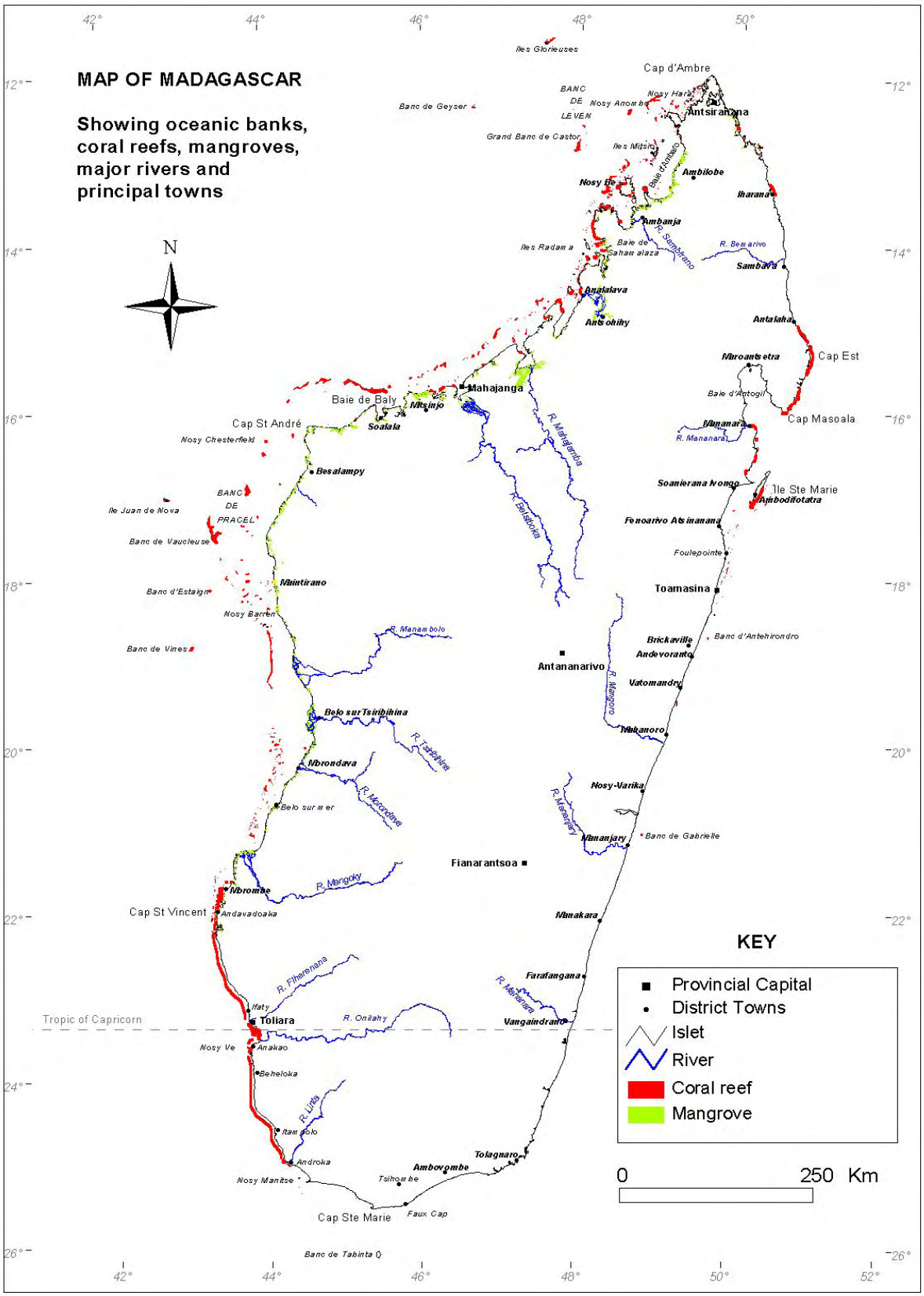


Figure G-6. Madagascar from space

Figure G-7. Existing protected areas, priority areas for conservation, existing forest cover and zones for sustainable natural resources use in the Fianarantsoa region. (Freudenberger 2008)

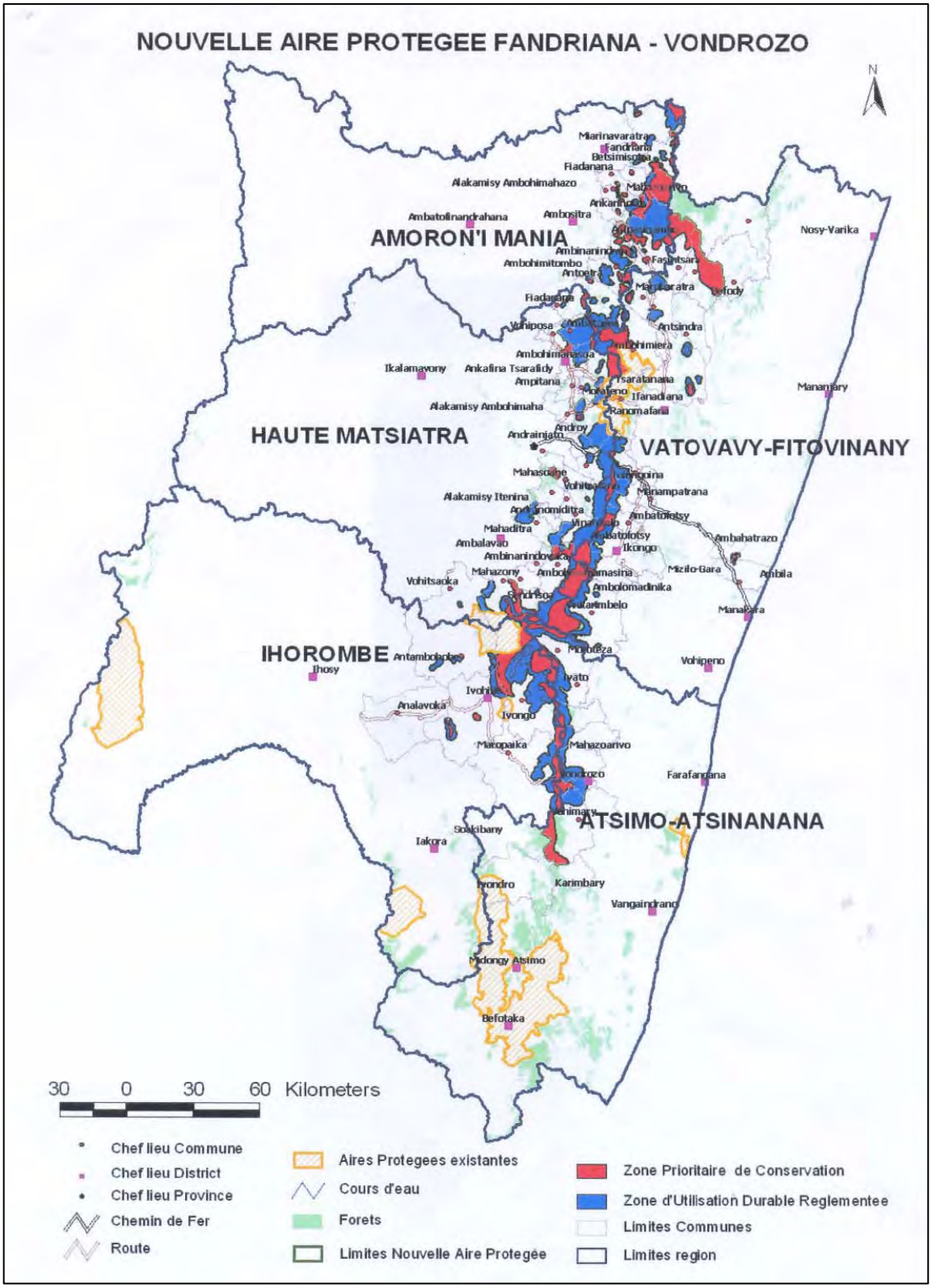


Figure G-8. Estimates of forest cover in Madagascar over time

Figure G-9. Evolution of forest cover in Madagascar

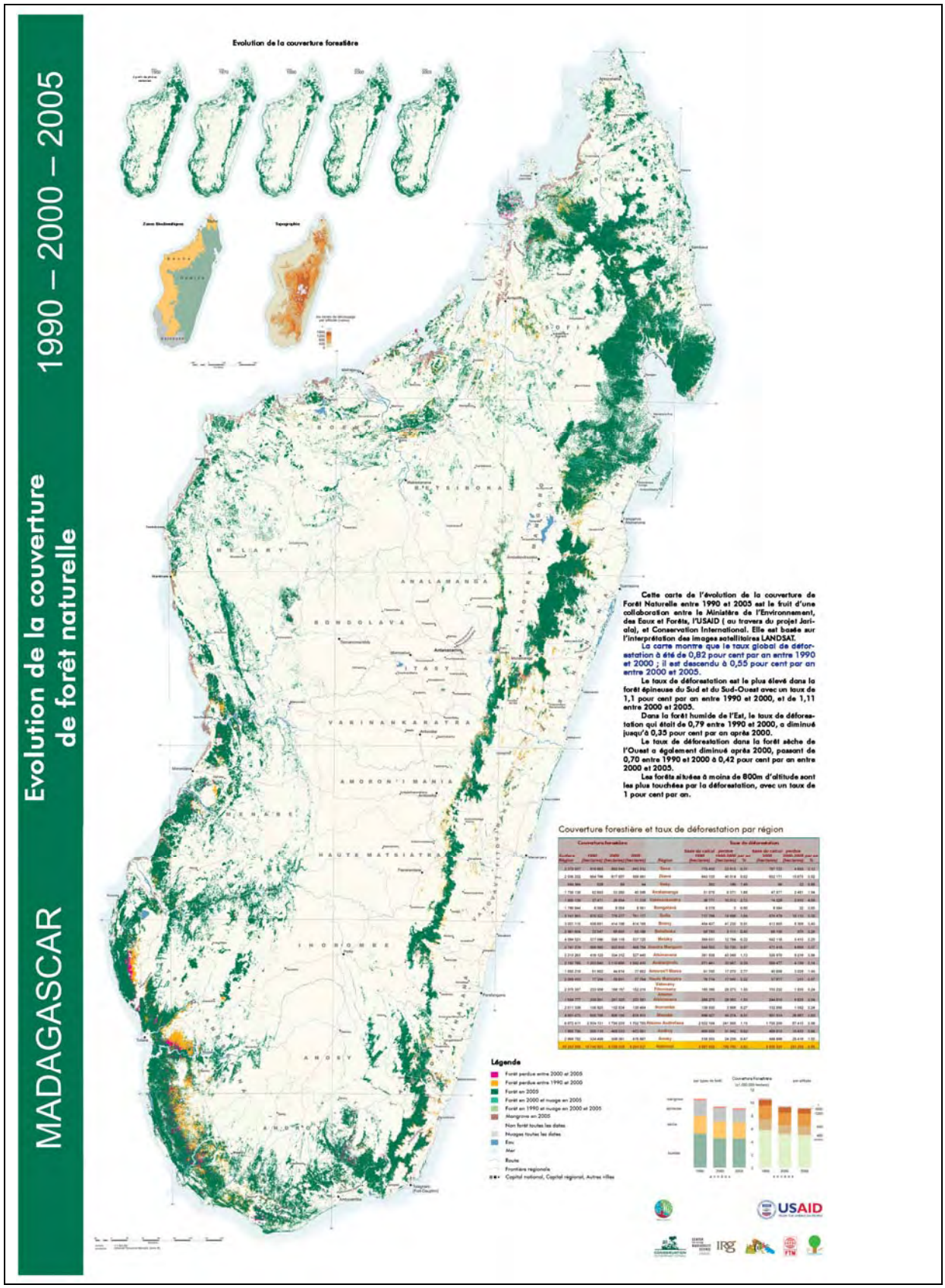
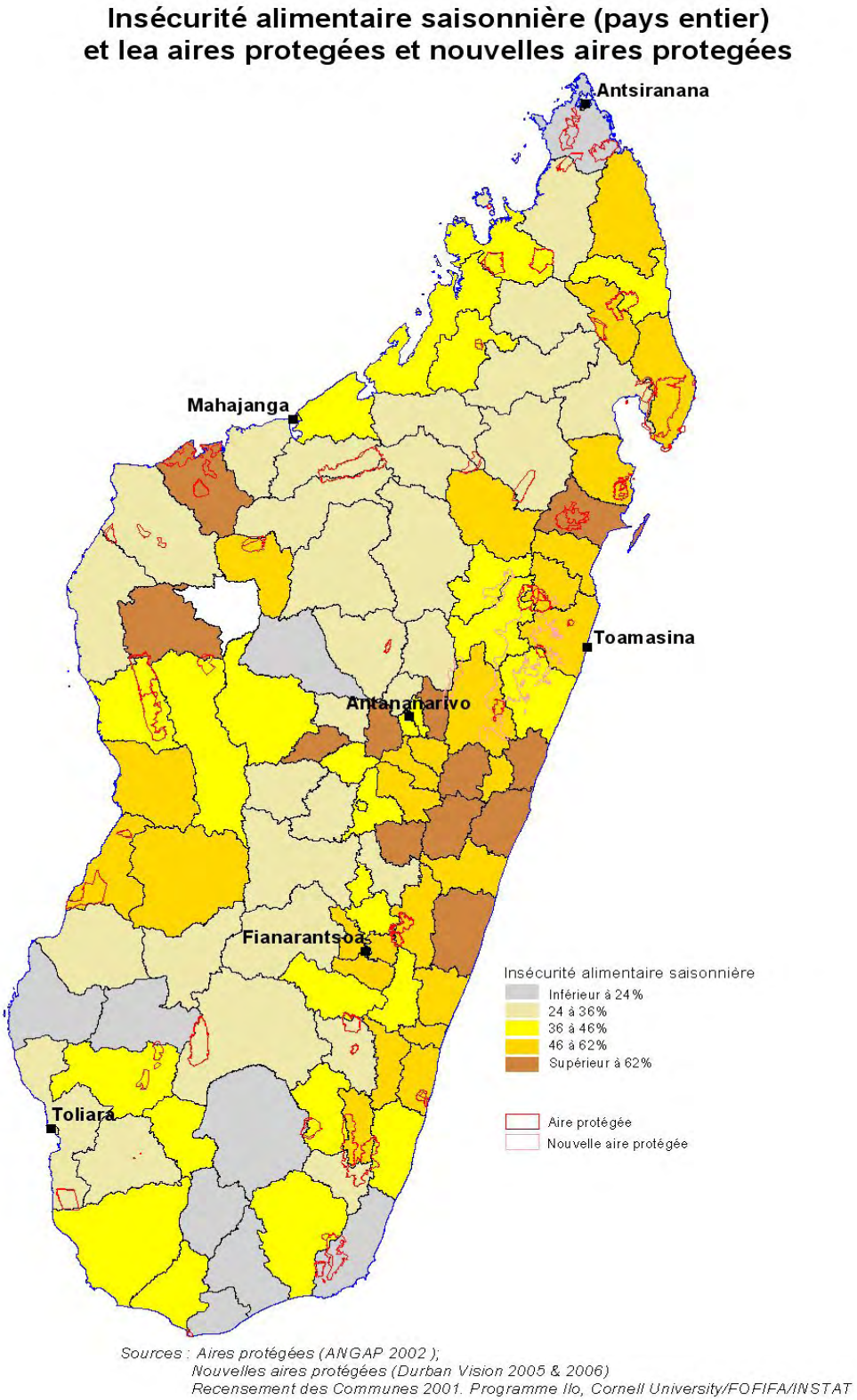
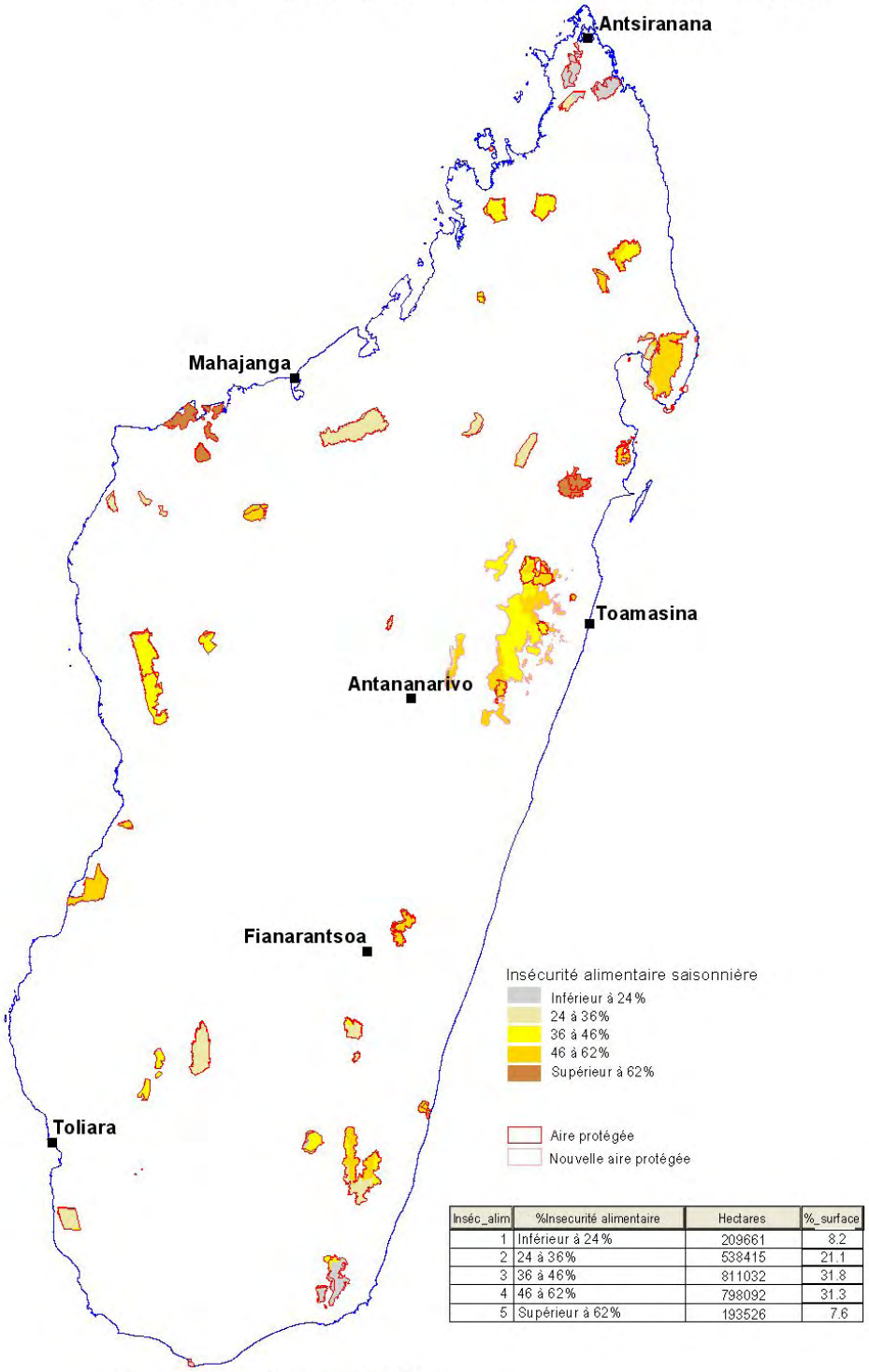


Figure G-11. Protected areas with seasonal food security indexes



Sources : Aires protégées (ANGAP 2002);
Nouvelles aires protégées (Durban Vision 2005 & 2006)
Recensement des Communes 2001. Programme Ilo, Cornell University/FOFIFA/INSTAT

Insécurité alimentaire saisonnière et les aires protégées et nouvelles aires protégées



Inséc_alim	%Insecurité alimentaire	Hectares	%_surface
1	Inférieur à 24%	209661	8.2
2	24 à 36%	538415	21.1
3	36 à 46%	811032	31.8
4	46 à 62%	798092	31.3
5	Supérieur à 62%	193526	7.6

Sources : Aires protégées (ANGAP 2002);
Nouvelles aires protégées (Durban Vision 2005 & 2006)
Recensement des Communes 2001. Programme Ilo, Cornell University/FOFIFA/INSTAT

Figure G-12. USAID implementing partners in the Tolagnaro (Ft. Dauphin) district

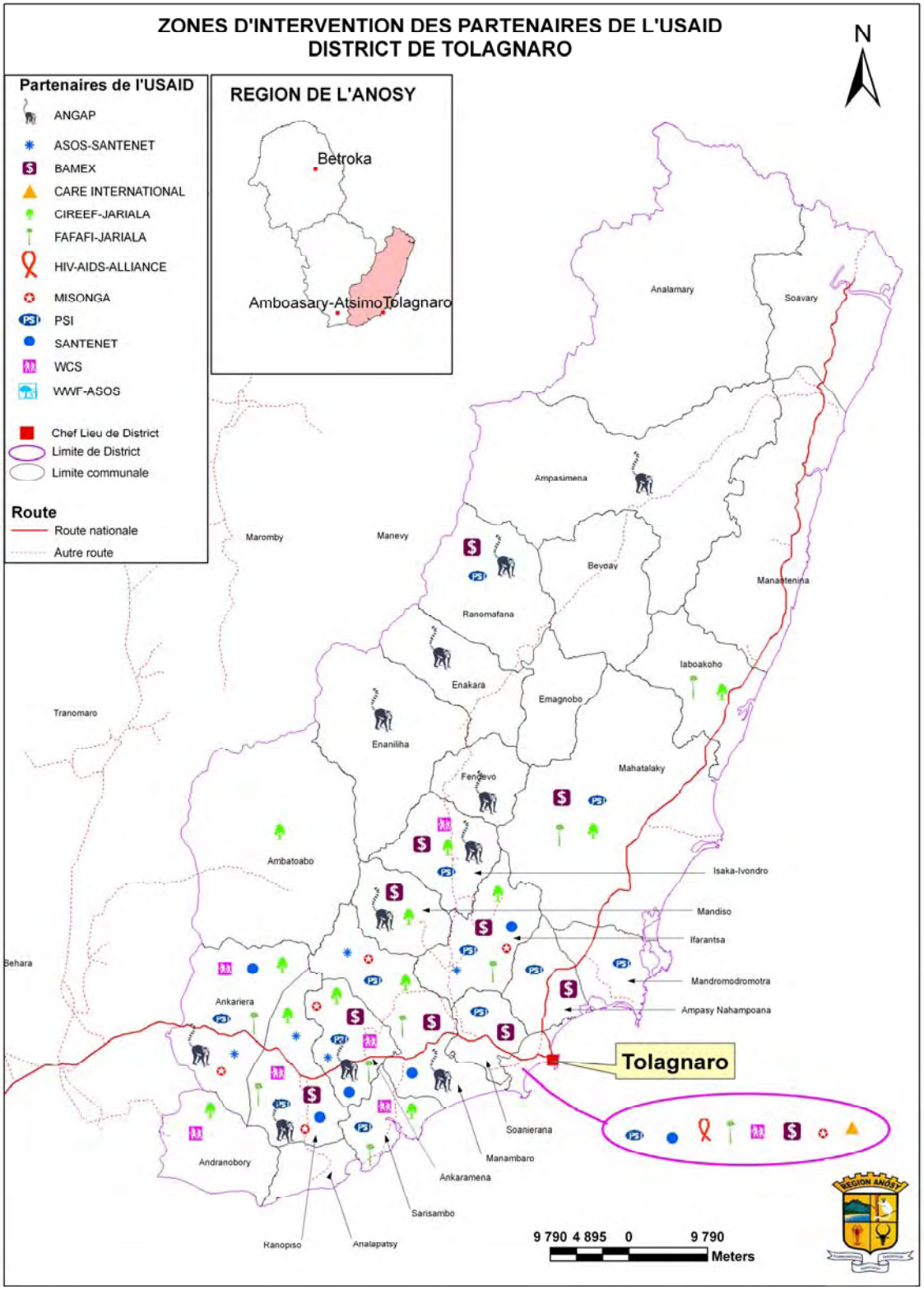


Figure G-13. Elevation contours for Madagascar