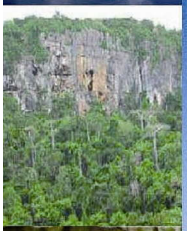






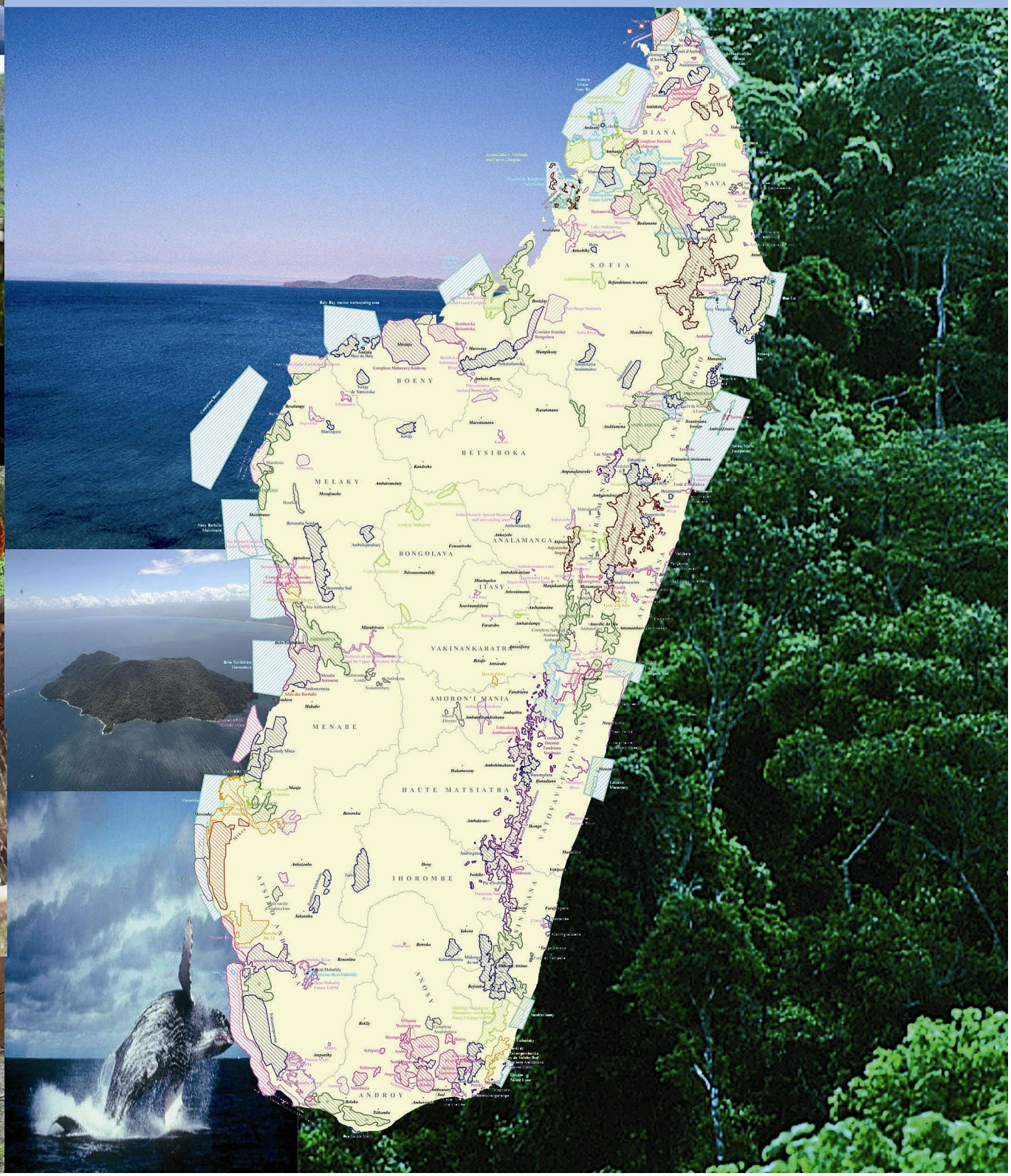

REPUBLIC OF MADAGASCAR
Tanindrazana-Fahafahana-Fandrosoana
Ministry of Environnement and Forest

MEF

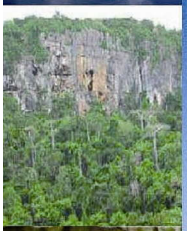
UNEP

4TH NATIONAL REPORT TO THE CONVENTION ON BIOLOGICAL DIVERSITY

MADAGASCAR







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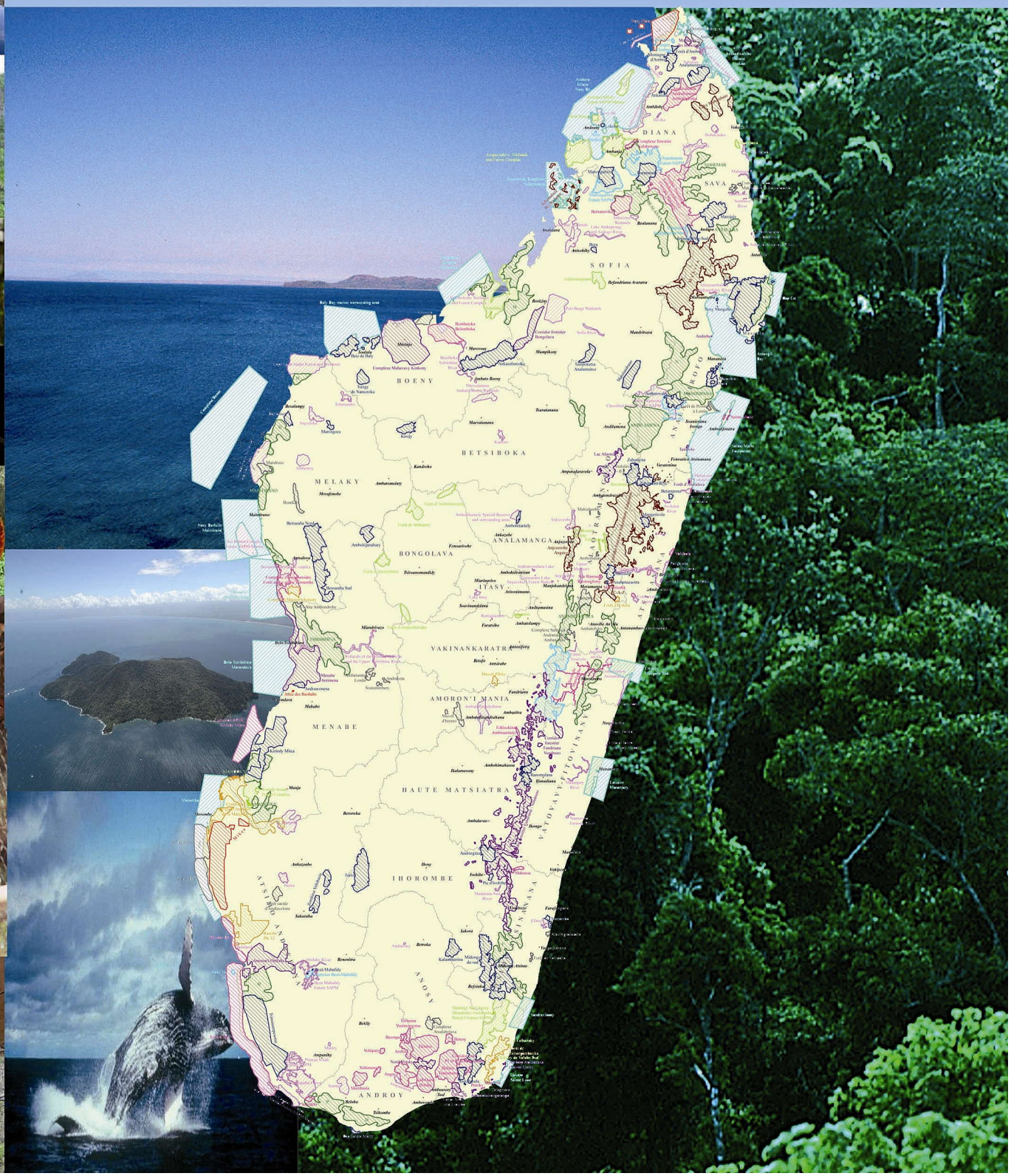

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RESUME EXECUTIF

Madagascar est un pays à mégadiversité, avec des niveaux élevés de concentration et d'endémisme. Au cours de ces dernières années, la connaissance aussi bien nationale que mondiale de l'état de sa biodiversité s'est beaucoup accrue, à l'exemple de la mise à jour de la liste UICN. Actuellement, l'écosystème Malgache sert comme habitat d'environ 12000 espèces de plantes, 370 espèces de reptiles, 244 espèces d'amphibiens, 283 espèces d'oiseaux, 154 espèces de poissons et 99 espèces et sous-espèces de lémuriens.

Cette biodiversité fournit de nombreux services écologiques importants pour le pays, et garantit le moyen de subsistance de plus de 18 millions d'habitants dont 80% vivent essentiellement des ressources naturelles. En plus des services écologiques et l'utilisation des ressources pour le bien-être humain, le potentiel écotouristique du pays reposant sur les aires protégées est actuellement la troisième source de devises pour Madagascar.

La tendance générale observée est l'érosion de la biodiversité, tant floristique que faunistique. Elle est due à des pratiques anthropiques destructives comme le défrichement des habitats primaires, de l'ordre de 0,55% par an et la surexploitation des ressources naturelles. Plus récemment, l'impact du réchauffement climatique sur les écosystèmes marins et côtiers s'avère potentiellement destructrice. Mais bien que la richesse biologique de Madagascar soit élevée, la connaissance de l'état de cette biodiversité n'est pas encore suffisante surtout en ce qui concerne le statut de conservation des espèces. Ainsi, l'action de conservation des espèces et la connaissance de la biodiversité méritent d'être approfondies et élargies dans d'autres domaines notamment l'agrobiodiversité.

Parmi les grands succès dans la mise en œuvre de la Stratégie Nationale pour la Gestion Durable de la Biodiversité et du Plan National d'Action Environnementale, citons :

- La mise en place de la Fondation pour les Aires Protégées et la Biodiversité de Madagascar (FAPBM) dans le cadre de la pérennisation des actions relatives à la préservation de la biodiversité et à la gestion durable des aires protégées. Par rapport à l'objectif sur la mobilisation d'un capital de 50 000 000 USD en 2012, le capital mobilisé est de 52 091 570 USD dont les bailleurs potentiels sont: WWF, Etat Malgache, KfW, Melissa Moye, Banque Mondiale, C2D, AFD, FFEM, CI/GCF;
- L'augmentation de la superficie des aires protégées de 1,7 millions d'ha à 6 millions d'ha, l'état d'avancement est de 79,20 % par rapport à l'objectif 2012 avec une superficie de 4 751 895 ha d'aires protégées créées, soit environ 8 % de la superficie totale du pays ;

- La nomination de la « Forêt humide de l'Atsinanana » composée de six parcs nationaux avec une superficie de 479661ha comme Site du Patrimoine Mondial au titre des critères IX et X le 27 Juin 2007 lors de la 31ème session du Comité du Patrimoine Mondial en Nouvelle Zélande ;

- Différentes stratégies et plans de conservation des espèces menacées ont été élaborés et opérationnels (amphibiens, caméléons, crocodiles, lémuriens, tortues, oiseaux, vositse et Prunus africana). Les statuts de conservation des groupes taxonomiques, amphibiens, mammifères et poissons ont été évalués selon les critères de l'UICN;
- Le reboisement d'une superficie de 34 925 ha en 2008 sur 25 000 ha prévu dont 357 ha de restauration de forêts primaires ;

- La réduction de feux de brousse en 2008 de 75% par rapport à 2002, année de référence.

La fragilité du financement ne peut pas garantir l'équité sur le partage des bénéfices et l'accès aux ressources, par conséquent ne peut pas assurer la réussite de cette stratégie pour la gestion durable de la biodiversité. Comme la majorité du financement est internationale, cette situation de fragilité est aggravée par la pauvreté et les crises politiques cycliques. En outre, l'évaluation de la politique nationale du commerce des espèces sauvages a signalé que les collecteurs ne bénéficient que de 0,08 à 0,25% de la valeur marchande du produit arrivé sur le marché international.

Parmi les mesures à prendre, on préconise l'amélioration de l'intégration du programme environnemental et du développement humain par un mécanisme permettant d'augmenter l'échelle de réalisation ainsi que la finalisation et la mise en œuvre de la stratégie des Accès et Partages des Avantages (APA).

Dans le cadre intersectoriel, l'application du décret MECIE à travers la création de la Cellule Environnementale au sein de tous les Ministères, l'octroi du Permis Environnemental ou de l'autorisation environnementale renforce l'intégration de la dimension environnementale dans chaque secteur. En dehors des tâches qui leur sont assignées par le décret les instituant, elles réalisent des activités qui ont trait à la protection de l'environnement au niveau de leur secteur respectif. Ces Cellules Environnementales jouent un rôle important en tant que garant de l'intégration de la dimension environnementale dans les politiques, programmes et projets de développement sectoriels. En vue d'une synergie et de complémentarité des actions, la coordination étant assurée au sein d'une Plate-forme intersectorielle sous l'égide du Ministère de l'Environnement et des Forêts.

Dix ans après la sortie de ce décret MECIE, il y a une volonté de la part des investisseurs à respecter les exigences légales. Ceci se traduit par un accroissement annuel du nombre de demande de permis environnemental auprès de l'Office National pour l'Environnement, 344 sur 426 dossiers déposés ont reçus des permis environnementaux. Ainsi, la création des aires protégées, les grands projets miniers, les projets pétroliers, les exploitations agricoles à grande échelle ont déjà appliqué les mesures à prendre dans le décret MECIE tels l'élaboration et mise en œuvre de l'Etude d'Impact Environnemental (EIE), l'élaboration du Programme d'Engagement Environnemental (PREE) et le Plan de Gestion Environnemental et de Sauvegarde Sociale (PGESS) pour minimiser la dégradation de l'Environnement. A l'exemple du secteur minier, les promoteurs s'engagent, dans le cadre des mesures de compensation, à appuyer la mise en place d'une zone de conservation (230 hectares incluant 160 hectares de forêt dans le cas de Mandena pour QMM) ainsi que la restauration écologique de la forêt.

La gestion de l'espace comme la superposition des blocs pétroliers, des carrés miniers avec les zones potentielles pour les aires protégées tant terrestres que marines et côtières reste un problème à résoudre malgré les efforts fournis en instituant les plate-formes de concertation tels que le Comité Mines-Forêts et le Comité *ad-hoc* Pétrole. Les stratégies sur l'intégration d'une meilleure gestion des aires protégées et de l'exploitation minière doivent-être améliorées afin d'éviter la dégradation de la biodiversité au cours de l'exploration ou de l'exploitation minière ou pétrolière. Il en est de même pour les autres secteurs tels le foncier, l'agriculture, l'élevage, la pêche et autres industries.

Des progrès vers l'objectif 2010 sont observés au niveau de la préservation des écosystèmes terrestres, aquatiques et marines par la création de nouvelles aires protégées, par l'utilisation des données scientifiques pour la priorisation des sites importants pour la biodiversité , la mise en œuvre de la politique de l'éducation relative à l'environnement, le système de suivi écologique, l'intégration de la dimension environnementale dans les secteurs, la mise en application du décret MECIE et la mise en œuvre des autres programmes liés à la protection de l'environnement.

Madagascar a priorisé les activités de conservation de la diversité biologique et de protection de l'environnement dans les politiques nationales de développement néanmoins il est nécessaire de déployer plus d'efforts sur l'intégration de la conservation avec le bien être humain, à savoir la lutte contre la pauvreté, la sécurisation alimentaire, la gestion rationnelle des ressources naturelles, l'équité en termes de partage de bénéfices et le financement du programme environnemental.

Les défis majeurs sont l'intégration du programme environnemental dans le développement du bien-être humain, la pérennisation financière et la recherche des moyens pour accroître et améliorer la production agricole de façon à assurer une augmentation de plus de 20% des besoins alimentaires d'ici 2020, tout en préservant la biodiversité.

EXECUTIVE SUMMARY

Madagascar is a megadiversity country with a high concentration of endemic species. In the recent years, information of biodiversity conservation status has grown significantly and the knowledge has improved at the local and global levels. Currently, the Malagasy ecosystem serves as home to approximately 12,000 species of plants, 370 species of reptiles, 244 species of amphibians, 283 species of birds, 154 species of fish and 99 species and subspecies of lemurs.

This wealth in biodiversity provides valuable ecological services for the country and benefits the livelihoods of more than eighteen million inhabitants (80% depend mainly on natural resources. In addition to ecological services and medicinal plants, the potential for ecotourism through the protected area network is enormous. Tourism is currently the third largest source of foreign currency for Madagascar.

The general trend is observed in biodiversity degradation, both for flora and fauna. This is primarily caused by human destructive practices such as clearing of natural habitats (0.55% per year) and overexploitation of natural resources. More recently, the impact of global warming on marine and coastal ecosystems has being observed as increasingly destructive. Though, biodiversity wealth of Madagascar is important, the knowledge on its status is yet insufficient particularly concerning the species conservation status. Thus, conservation activities of species and the knowledge should be improved and extended to other domains such as agrobiodiversity.

Among, the success in the implementation of the National Strategies of Biodiversity Sustainable Management and the Environmental National Action Plan are the following:

- The establishment of the Foundation for Protected Areas and Biodiversity of Madagascar (FAPBM). The objective on mobilizing capital was 50, 000,000 USD by 2012; however, mobilized capital has reached 52 091 570 USD. Potential donors include: WWF, Madagascar, KFW, Melissa Moye, World Bank, C2D, AFD, FFEM, GEF, FW, CI / GCF,

- The increase of protected areas from 1.7 million hectares to six million ha, representing a progress of 79.20% compared to the 2012 goal with the creation 4 751 895 ha of protected areas, which is about 8% of the country total surface area,

- The « Humid Dense Forest of the East composed by six national parks with a total area of about 479661ha was nominated as a World Heritages site under IX and X criteria in June, 2007 during the 31th meeting of the World Heritage committee in New Zealand,

- Regarding the conservation of threatened and endemic species, various conservation strategies and plans for conservation of endangered species have been successfully developed and implemented (amphibians, chameleons, crocodiles, lemurs, turtles, birds, vositse and *Prunus Africana*). Assessment on the conservation status of other taxonomic groups (amphibians, mammals and fish) has also been conducted according to the IUCN criteria,

- Reforestation efforts have covered an area of 34 925 ha; this is higher than the 2008 objective of 25 000 ha to be planted and 357 ha to be restored, and

- In 2008, the fight against bush fires resulted in reduction of 75% of the burned areas compared to 2002

The vulnerability of funding cannot guarantee equitable benefit sharing and access to natural resources. Consistently, it cannot insure the success of the success of this strategy of sustainable

biodiversity management. The majority of the funding is international and this situation is worsened by poverty and cyclic political crisis.
In addition, the evaluation of the national policy in 2008 revealed that the collectors only benefit from 0.8 to 0.25% of market value of the product sold on international markets.

Among the measures to be undertaken, the improvement of the environmental program integration with human development through a system allowing to up scale the impact of biodiversity conservation in human well-being and to implement the strategies of Access and Equitable Benefit sharing are recommended.

The challenge is how to increase and improve agricultural production while maintaining healthy ecosystems, particularly in the context of an increase of over 20% of global food needs by 2020. Under mainstreaming, the application the improvement of Decree MECIE such as the creation of the Environmental Cell in the sector ministries, the granting of environmental permits, and implementing the Program of Environmental Commitment (PREE) all help strengthen this integration.

Regarding the mainstreaming, the use of the MECIE decree through the creation of the environmental cells in all the ministries, and the granting of the environmental permits reinforce the integration of the environmental dimension in each sector. Apart from their own tasks, they do carry out activities related to environmental protection in their respective sectors. These Environmental cells play an important role in guaranteeing critical integration of environmental dimensions into development policies, programs and projects. For synergy and complementarities of activities, these cells are coordinated under a platform coordinated by the Ministry of Environment and Forests.

Ten years after the implementation of the MECIE decree, there is now a willingness from investors to comply with legal requirements. As a result, there is an annual increase of the number of applications submitted to the “Office National pour l'Environnement” for environmental permits; about 344 out of 426 applications received environmental permits.

Therefore, the process for protected area creation,, large mining projects ,, Petrol and oil projects, large scale agricultural exploitation have already adopted the requirements under the MECIE decree such as development and implementation of the Environmental Impact Assessment (EIA) and Environmental Management and Social Safeguard Plan (PGES). In order to mitigate environmental degradation, For example, the mining sector adopts a framework of compensatory measures, and this provides support to the establishment and management of a conservation area (230 hectares including 160 hectares of forest in Mandena area for QMM), as well as ongoing efforts to support ecological restoration.

Land management such as the overlapping of oil blocks, mining squares with terrestrial, marine and coastal potential protected area zones is a challenge to be addressed despite the efforts in bringing consultation plateforme such as Mine-Forest and Ad’Hoc Petroleum committee. Strategies on the integration of protected areas management with mining exploitation should be improved in order to avoid biodiversity degradation during mining and petroleum exploration or exploitation. This is also the case for the other sectors such as land use, agriculture, farming, fishery and other industries.

Progress towards the 2010 targets are observed on the successful conservation of terrestrial, aquatic and marine resources through the creation of new protected areas, the use of scientific data to prioritize key areas for biodiversity, the implementation of environmental education policies, the implementation of environmental monitoring system, the integration of the environmental dimension in the sectors, the implementation of MECIE Decree and the implementation other environmental protection programs.

Madagascar prioritizes activities for the biodiversity conservation and environmental protection in the national development policy, nevertheless, it is necessary to add more efforts on the integration of biodiversity conservation in human well-being such as poverty alleviation, food

security, rational natural resources management, equitable benefit sharing, and Environmental program funding.

The major challenges are the integration of environmental policies with human well-being development, sustainable financing mechanisms, and improvement of food crops in order to insure a 20% increase of food needs until 2020 while preserving biodiversity.

INTRODUCTION

The island of Madagascar is located between longitudes 43° and 51° east and latitudes 12° and 26° south, 400km east of Africa from which it is separated by the Mozambique Channel. Due to its surface area, approximately 590,000km², it is the fourth largest island in the world after Greenland, New Guinea, and Borneo.

It was separated from the big Gondwana continent of between 80 and 140 millions of years ago and its fauna and flora were probably saved in a complete isolation. An extremely wide diversity of habitats, biodiversity, and climates emerged from the evolution of its biodiversity. Madagascar is considered as a "real micro-continent".

Madagascar is located in the center of the megabiodiversity area of Western Indian Ocean and neighboring islands. Many Malagasy species of fauna and flora are globally known to be unique and endemic at the local, regional, and international levels.

Concerning precipitation, annual rainfall in Madagascar varies from 350 millimeters on the Southwestern coast to nearly 4,000 millimeters in the bay of Antongil and the mountains of Tsaratanàna. The annual average number of rain days ranges between thirty (30) and 250. On the western side and on the highlands, the rainy period is from October to April (90 to 95% of the annual total rainfall). On the eastern side of the island, the dry season is not clearly defined, there is just less rainfall in September and October.

Concerning temperatures, annual averages range between 14°C and 27.5°C. On the littorals, they vary with latitude, from 27°C in the North to 23°C in the South. The western coast is warmer than the eastern with a difference of 1°C to 3°C. On highlands, annual average temperatures range between 14°C and 22°C. The lowest average temperature is recorded in July and for most regions, the hottest temperature is recorded in January and February, except some areas of the Highlands and the Northwestern region where it is recorded in November.

Madagascar has 19.5 million inhabitants and the population growth rate is about 3.3% per year. Since 2008, Madagascar has ranked among medium human development countries with a HDI (Human Development Index) of 0.533. Thirty-six percent (36%) of its population live under the poverty line, with a daily income of less than USD 1.25 per day (www.statistiques-mondiales.com/, July 2009).

Natural resources conservation is not a new idea for Madagascar. In the 1930's, the country already had enforced the legislation on nature protection such as the decree of January 25, 1930 defining the rules for rational valorization of forests ; ordinances 60-126, 60-127, 60-128 about hunting and wild fauna categorization, clearing and bushfire control – which are a real threats for Madagascar's biodiversity, and the procedures of lawsuit as a repression tool. Different decrees and text were used to classify biodiversity importante areas into Natural Reserves. These efforts were recently furthered through increase of the surface of protected areas and a revision of their categorization status.

The present document reports on the progress toward the implementation of the National Strategy for Biodiversity Sustainable Management against the biodiversity 2010 target, the convention on biological diversity strategic plan, and actions to take. As such, four chapters have been included in the present report, namely:

Chapter I: Overview of Biodiversity Status, Trends and Threats
Chapter II: Current Status of National Biodiversity Strategies and Action Plans
Chapter III: Sectoral and Cross - sectoral Integration or mainstreaming of biodiversity considerations
Chapter IV: Conclusions: Progress Towards the 2010 Target and Implementation of the Strategic Plan

CHAPTER I

OVERVIEW OF BIODIVERSITY STATUS, TRENDS, AND TRHEATS

PART I: STATUS AND TRENDS OF THE BIOLOGICAL DIVERSITY

I. TERRESTRIAL BIODIVERSITY

A. FOREST ECOSYSTEMS

A.I. STATUS

The last description of Madagascar's vegetation was done by Koechlin and al. in 1974. It was updated by Moat and Smith in 2007 in the "Atlas of Madagascar's Vegetation".

This Atlas identifies 15 types of terrestrial ecosystems: a primary forest composed by rainforest, dry forests in the West, dry spiny thicket in the South-West, sub-humid forest in the West, rainforest in the West, wooded herbland, bushy, coastal bushy in the South-West, Tapia forest, and coastal forests. Table 1 shows the different types of terrestrial ecosystems. Among the primary forests, the rainforest is the most widely represented with 47,747km², and the rainforest in the West has smallest extension with 72km².

Picture 1: Nosy Mangabe. Conservation International

Table 1: Different Types of Terrestrial Ecosystems

Type of ecosystem	Total surface area in 2005	% land cover
1- Grassland mosaic– plateau grassland wooded	246,687 km²	41.67%
- Wooded grassland– bushland	135,739 km²	22.93%
3-Degraded humid	58,058 km²	9.81%
4-Humid forest	47,737 km²	8.06%
5-Western dry forest	31,970 km²	5.40%
6-Cultivation	23,522 km²	3.97%
- South western dry spiny forest-thicket	18,355 km²	3.10%
8- Wetlands	5,539 km²	0.94%
- Degraded south western dry spiny forest	5,427 km²	0.92%
Western sub-humid forest	4,010 km²	0.68%
11-Mangroves	2,433 km²	0.41%
South-western coastal bushland	1,761 km²	0.30%
13- Tapia forest	1,319 km²	0.22%
14- Littoral forest	274 km²	0.05%
15- Western humid forest	72 km²	0.01%

Source: Moat et Smith, 2007

A.2. TRENDS

Deforestation

Deforestation is a major threat to the ecosystems. The table below shows changes in the deforestation rates per type of forest from 1990 to 2005.

Table 2: Deforestation Rate per Type of Forest (Conservation International, 2007)

Type of forest	baseline 90 (ha)	Lost 90-00 (ha)	% per year	Baseline 00 (ha)	Lost 00-05 (ha)	% per year
Rainforest	4,133,374	326,835	0.79	3,870,076	67,978	0.35
Spiny	2,412,790	264,697	1.10	2,148,089	119,388	1.11
Dry	2,801,609	195,307	0.70	2,593,159	53,939	0.42
Mangrove	255,760	4,361	0.17	250,114	0	0.00
Others	1,999	34	0.17	1,982	50	0.50

Source: MEFT, USAID and CI, 2009

The followings are noted:

- The overall deforestation rate in Madagascar was about 0.82% per year during the 1990's and decreased to 0.55% per year over the 2000-2005 period;
- The highest deforestation rate concerns the spiny forest, with a rate of 1.1% in the 1990's and after 2000. The rainforest deforestation rate decreased to 0.35% per year after 2000;
- After 2000, the dry forest deforestation rate decreased from 0.70% to 0.42% per year.

Though this decrease of national deforestation rate, critical habitats are shrinking in some areas and continuous fragmentation threatens biodiversity of Madagascar.

All studies on forest cover change confirm a couple of evidences: the decrease of forest cover from 1990 to 2005 (except for mangrove ecosystem), and the decrease of deforestation rate. The evolution of each ecosystem area is described in the table below.

Table 3: Forest Cover Changes for Forest and non-Forest Ecosystems

	1990 (ha)	2000 (ha)	2005 (ha)
Humid forest	5,254,306	4,538,649	4,489,248
Spiny forest	2,413,283	2,148,214	2,028,798
Dry forest	2,828,960	2,611,790	2,539,319
Mangrove	264,613	252,405	252,405
Other	2,936	2,140	2,247

Source: MEFT, USAID and CI, 2009

B. PLANT BIODIVERSITY

B.1. STATUS

Despite the closeness of the African continent, Madagascar's flora composition is unique, due to its high endemism level. About 12,000 plants species are known to date, of which 90% are endemic species. About 4,000 species remain to be discovered and taxonomists working on Madagascar's flora describe 100 species per year (MBG, 2009).

Actually, the Malagasy endemic plant families includes: Asteropeiaceae, Barbeuiaceae, Diegodendraceae, Physenaceae, Sarcolaenaceae, and Sphaerosepalaceae. The quasi-endemic plant families include Didiereaceae with four genera endemic to Madagascar and three African genera, and Didymelaceae with one genus from Madagascar and the Comoros Islands.

Humbertiaceae, Melanophyllaceae, and Taktajaniaceae families are no longer included among the Madagascar endemic families and are respectively included in the families of Convolvulaceae, Torricellliaceae, and Winteraceae. For trees and shrubs, 103 families are known (including five endemic families) containing 490 genera (including 162 endemic genera), and 4,220 species (including 4,032 endemic species).

For the pteridopythes, 106 genera are known, including one endemic genus, *Psammiosorus*. Among the 586 species inventoried, 265 are endemic. The table below illustrates the number of plant genera and species endemic to Madagascar.

Table 4: Number of Plant Genera and Species Endemic to Madagascar

	Genera		Species	
	Total	Endemic	Total	Endemic
Trees and shrubs	490	161	4,220	4,032
Pteridophytes	106	1	586	265

Source: www.eFlora.org, 2009

Some groups need special attention such as palm trees, orchids, and leguminous plants.

B.1.1. Palm trees

Madagascar is known as one of the rich spots of palm trees (Arecaceae) in the world. Among 2,375 species recently inventoried in tropical and sub-tropical areas (Govaerts & Dransfield, 2005), 194 are found in Madagascar. This richness is essentially characterized by a very high level of endemism (about 100%), not only at the genus level or but also at species level (Rakotoarinivo 2008). Among the 184 indigenous species, only five are not endemic. It is noticed that the abundance of palm species in Madagascar is three times higher than that of the entire African continent (Dransfield and Beentje 1995, Govaerts and Dransfield 2005).

*Dypsis (*quasi-endemic) is the main genus palm flora seen in Madagascar. Among 154 Dypsis species currently known, only three species are found outside of Madagascar. In addition, the genera of *Beccariophoenix, Bismarckia, Lemurophoenix, Marojejya, Masoala, Tahina, and Voanioala* are all specific to Madagascar.

Before 1995, 70 palm species were described and in 1995, 171 were described (Dransfield et Beentje 1995, Govaerts et Dransfield 2005; Rakotoarinivo 2008). Currently, 16 genera are known and 191 species have been described, among which 166 are endemic species (source: **www.eFlora.org**, 2009).

B.1.2. Orchids

Orchid species represent 10% of Madagascar's flora species. In 1999, 960 species were inventoried, including 105 new species, 11 new varieties, and 62 new combinations. Currently, 1,000 orchid species are known, of which 850 are endemic, i.e. 85% (Sources: Dupuy et al. 1999; **www.eFlora.org**).

B.1.3. Leguminous plants

Currently, 667 species of leguminous plants (*Fabacaee)* are known, including 573 indigenous species and 94 species introduced and naturalized in Madagascar (Dupuy et al., 2002).

B.2. TRENDS

Each year, the Madagascar's Plants Specialists Group (GSPM) assesses the conservation status of plant species. Since 2007, the GSPM has submitted about 700 species to IUCN's for validation. For the 2008-2009 periods, the total number of species submitted to IUCN for classification was 1,848, including 504 critically endangered species, 868 endangered species, and 476 vulnerable species. The number of threatened species in IUCN's red list (2007 and 2008) is illustrated below:

Table 5: Changes in the Number of Threatened Species (www.iucn.org)

	2007	2008
Critically endangered species	62	62
Endangered species	101	101
Vulnerable species	117	119

Source: UICN Redlist 2007and 2008

It should be noted that the number of plant species classified under the IUCN categories is lower than the total number of species existing in Madagascar.

C. FOREST PLANT GENETIC RESOURCES

C.1. STATUS

The National Silo for Forest Seeds (SNGF) is the institution in charge of sustainable management of forest plant genetic resources in Madagascar. Then, research and indoor storage is being conducted for fifty species. For the implementation of Global Plant Conservation Strategy, under the Millennium Seed Bank project, sample seeds of 2,000 species are stored for long-term conservation in the SNGF's seeds bank.

Potentialities for forest genetic resources, including ligneous species, ornamental plants, and endangered species plants are not yet assessed. In some ecosystems, their endemism rate is estimated at 90% and more than 30 endangered species are going to be extinct (SNGF, 2009).

The other forest species have significant social and economic value. This set includes medicinal and aromatic plants (estimated about 10,000 species), species with edible fruits, and endemic oleaginous plants.

C.1.1. Medicinal plants

Medicinal plants could include forest plants, self-sown and self-propagating plants. Some forest endemic species with economic potentialities value are being exported. They belong to the genera *Cedrelopsis*, *Ravensara*, *Vepris*, *Canarium*, *Uncarina*, *Hernandia*, *Moringa*, etc. The Malagasy traditional pharmacopoeia identified about 2,300 medicinal species. Despite their potentialities demonstrated by their traditional use, 90% of these are not yet traded as sources of drugs or phytochemical molecules.

C.1.2. Indigenous aromatic plants

At the global level, the estimated number of aromatic species being currently commercialized does not exceed 200. Actually, 62 aromatic plant species from 26 families are inventoried within the Madagascar national flora, including 34 forest species and 28 savanna species. In this set, 49 out of 62, about 72%, are ligneous plants species and the remaining are herbaceous plants.

C.2. TRENDS

The table below highlights the increase in the production and sales of indigenous seeds by the SNGF.

Table 6: Production and Sales of Indigenous Seeds

Years	Production of indigenous seeds (kg)	Sales of indigenous seeds (kg)
2004	185,504	241,714
2005	200,401	200,611
2006	243,299	250,401
2007	514,659	315,518
2008	745,416	475,646

Source: SNGF, 2009

D. ANIMAL BIODIVERSITY

D.1. STATUS

D.1.1. Amphibians

There are currently 244 species of amphibians in Madagascar. This exceptional richness represents 4% of the world's amphibian fauna and is characterized by an endemism rate of almost 100% (Vletes and al., 2009). Among the 451 sites where the species have been recorded, 87.3% are located in protected areas (Vletes and al., 2009).

According to IUCN (2009), 64 species are threatened, which is about 26.22% of the total Malagasy batracofauna. Among these threatened species, seven are critically endangered species, 27 species are endangered, and 30 are vulnerable species. 82% of these threatened taxa are represented in the current network of protected areas and therefore benefit from local protection (F. Andreone and al., 2005). However, 23.3% of the species recently described and five out of seven critically endangered species are found outside of existing protected areas network: *Mantella aurantiaca*, *M. cowani*, *M. milotympanum*, *Mantidactylus pauliani, and Boophis williamsi.* Because of the Madagascar's commitment to tripling surface of protected areas, habitats for *Mantella aurantiaca*, *M. cowani and M. milotympanum* will be included in the set of new protected areas. Two other threatened species, *Anodonthyla rouxae* (EN) and *Rhombophryne coronata* (VU) are not yet integrated in the actual protected areas. Special attention should be paid to these species in defining the new protected areas, as recommended in the Sahonagasy Action Plan.

46 known amphibian species (i.e. 20.6%) fall in the category "Data Deficient". The boundaries of their geographical distribution remain poorly unknown, and it is difficult to define relevant recommendations for their conservation. Research is needed to update information for their conservation status assessment.

D.1.2. Reptiles

There are currently 370 species of reptiles in Madagascar, with a 92% rate of endemism (Glaw and Vences, 2007). This exceptional richness represents 4% of the global reptilian fauna known to date (WikiAnswers.com, accessed on May 29, 2009). Furthermore, new forms have been discovered, such as the rare snake *Liophidium maintikibo* (Franzen and al., 2009), encountered only in a restricted range area, outside of protected areas. Few reliable data are now available to update the conservation status of most reptilian taxa. However, it should be noted that four species live in the areas located out of the current Protected Area System: the chameleon *Furcifer belalandaensis* in the dry forest, north to Fiherenana river, the bamboo specialist gecko *Phelsumpa klemmeri* in the region of Ambanja along Sambirano river, the gerrhosauridae typical of the low altitude humid forest of the southeastern extreme of Madagascar, *Zonosaurus anelanelany* (Raselimanana, 2009) and *Liophidium maintikibo* in the dry deciduous forest, north to Morondava (Franzen and al., 2009).

In addition, 15 Malagasy endemic reptile species are threatened according to IUCN Redlist 2009: six critically endangered (CR), one endangered (EN), and eight vulnerable (VU).

a) Chameleons

Madagascar has at least 74 endemic chameleon species (Glaw and Vences 2008). While most of the chameleons are represented in the Madagascar Protected Areas System (Raselimanana and Rakotomalala 2003), some species are encountered in the sites that have just received a protection status, such as *Calumma hafahafa.*

Four species of them are classified as vulnerable: *Brookesia perarmata, Furcifer minor, Furcifer campani, and Furcifer labordi*. However, this status is now outdated and a re-assessment has

been initiated in 2009. It will contribute to the conservation planning of protected areas and provide an accurate baseline for future changes.

According to IUCN's Red List in 2009, eight reptilian species are classified as vulnerable and six species are critically endangered: *Phelsuma antanosy, Erymnochelys madagascariensis, Astrochelys radiata, Astrochelys yniphora, Pyxis arachnoids, and Pyxis planicauda.*

b) Tortoises

Four endemic species are found in Madagascar: *Astrochelys radiada, A. Yniphora, Pyxis planicauda, and P. arachnoides oblonga.* All of them are critically endangered (cf. IUCN's assessment of terrestrial tortoises' conservation, 2008)

D.1.3. Birds

As described by Goodman and Hawkins (2008), Madagascar has fewer bird species compared to other African countries. The total number of species is 283, among which 209 regularly nest on the island. Out of the 209 nesting species, only seven species (3%) are seasonal visitors' species from Africa. The endemism level is outstanding and mostly related to forests: 51% of nesting species are endemic to Madagascar. There are 151 terrestrial species (including species in open habitats). More than 46% of them are endemic and 80% of them are forest species that are found nowhere else.

Most of the species, except for erratic species, are represented in protected areas. 18 terrestrial species (11.9%) are threatened (IUCN Red List 2009), including three (2.0%) endangered (EN) (*Eutriorchis astur, Monticola erythronotus*, and *Xenopirostris damii*), and 15 (9.9%) vulnerable (VU) species.

D.1.4. Mammals

a) Small mammals

Madagascar contains a large range of endemic species of non flying small mammals from two groups: the *Nesomyidae* sub-family which is composed by 27 species and includes all endemic rodents of Madagascar, and the *Tenrecidae* family, diversified into 32 species (Bronner and Jenkins, 2005, Goodman and al., 2008a; Olson and al.). The endemism status of *Suncus madagascariensis* is uncertain. Three species of the Murinae sub-family, *Rattus rattus, R. norvegicus, and Mus musculus*, as well as a Soricidae species, *S. murinus* are allocthonous and were introduced by men on the Island.

For Chiroptera (bats), a total of 38 species, grouped in seven families are found in Madagascar (Goodman and al., 2008a; 2008b). Among them, 24 are endemic to country and three species known on the Comoros Islands. It should be noted that out of the 38 species, three species belong to the Megachiroptera and 35 species to the Microchiroptera. Only one family of Mizopodidae composed by two species is endemic, with two species.

Most Malagasy small mammal species are well represented in conservation sites, new protected areas.

b) Carnivorous

Madagascar's indigenous carnivorous fauna is composed by eight species in the endemic family of Eupleridae (Wozencraft, 2005). Among them, five species are found in the eastern humid forest, and two species have a restricted dry forest distribution area: *Galidictis grandidieri* at east of

Tsimanampetsotsa lake, and *Mungotictis decemlineata*. The indigenous carnivorous species has forest affinities features. Three species of carnivorous were introduced in Madagascar: the domestic dog and cat (*Canis lupus* and *Felis silvestris*) and the Indian civet (*Viverricula indica)* (Goodman and al., 2008a).

c) Lemurs

Madagascar is the top global priority spot for primate conservation due to their high diversity and unequalled endemism on the island. It ranks third among countries with high diversity of primates with its five families, 15 genera, and 98 species and sub-species. Because of the data needs on diversity, taxonomy, and distribution of Malagasy primates that are fundamental for the conservation efforts and the maintenance of this zoological group's diversity, a recent information on diversity of Malagasy lemurs has been published recently by Mittermeier and al., in 2008 (cf. Table 7).

Table 7: Diversity of Malagasy Lemurs

Families	Genera	*Species*	Number	Name in Malagasy (translated)
Cheirogaleidae	*Microcebus*	spp.	15	Mouse lemur
	Allocebus	*trichotis*	1	Hairy-eared lemur
	Mirza	spp.	2	Giant mouse lemur
	Cheirogaleus	spp.	7	Dwarf lemur
	Phaner	spp.	4	Fork lemur
Lepilemuridae	*Lepilemur*	spp.	25	Sports lemur
Lemuridae	*Hapalemur*	spp.	6	Bamboo lemur
	Prolemur	*simus*	1	Bamboo lemur
	Eulemur	spp.	12	Real lemur
	Lemur	*catta*	1	Maki
	Varecia	spp.	4	Vari lemur
Indriidae	*Avahi*	spp.	9	Woolen lemur
	Propithecus	spp.	9	Propitheque
	Indri	*indri*	1	Indri
	Daubentonia	*madagascariensis*	1	Aye-Aye

Source : GERP, 2009

Most of lemur species are assessed under IUCN's Red List (2008) and 41% of them are classified as threatened, including six critically endangered species, 17 endangered species, and 14 vulnerable. Flagship species and threatened species are considered as conservation target in most protected areas management plan. However, five species rank among the 25 primate that are in peril at the global level: *Prolemur simus*, *Eulemur cinereiceps*, *Propithecus candidus*, *Lepilemur septentrionalis* and *Eulemur flavifrons* (Mittermeier *et al*., in prep.).

D.2. TRENDS

D.2.1. Amphibians

The knowledge of the Malagasy amphibians' diversity has tremendously improved during last decades: The number of species known increased from 133 species to 244 species. From 2003 to 2009, 45 additional species are known, i.e. a local rate of increase 22.6% (Table 8), and a global rate of increase about 4%. Currently, 150 new species are under description (Andreone and Randriamahazo, 2008).

Table 8: Changes in Knowledge of Batracofauna Diversity since 1991

	1991	**1994**	**2003**	**2005**	**2008**	**2009**
Number of amphibian species	133	170	199	220	238	244

There are no significant changes on threats on species since 2005. Among the 238 species assessed last year, 66 are threatened, i.e. 27.7% of the Malagasy amphibian fauna, which is still the

same proportion as given by Andreone and al. (2005) at 25% (55 species out of the 220 assessed). This change is shown in the following table:

Table 9: Change in the Number of Amphibian Species According to IUCN Red list categories

	2003	2004	2006	2007	2008
Critically endangered species	N/a	9	9	9	7
Endangered species	N/a	21	21	21	27
Vulnerable species	2	25	25	25	30

Source: IUCN 2008. IUCN Red List of Threatened Species. Version 2009.1. <www.iucnredlist.org>.

During the amphibian assessment, *Mantella manery* has been uplisted from "Data deficient" category (DD) to "Vulnerable". Its currently known distribution area extended up to Tsaratanana, is highly fragmented and degraded – (Andreone and al., 2008), and two species, *Mantella expectata* and *Scaphyophryne goleibei* are downlisted from "Critically Endangered" (CR) status to "Endangered" (EN) category, due to a significant extension of their known distribution area (Andreone and al., 2008).

D.2.2. Reptilians

Since 1991, the knowledge on Malagasy reptilians' diversity has significantly increased by 31% (1991-2009), due to the discovery of new forms.

Table 10: Changes in the Number of Reptilians Species

	1991	1994	2003	2005	2008	2009
Number of reptilian species	282	290	340	340	370	370

Due to the lack of knowledge on the biology and ecology of some arboreal and excavating species, some forms have been considered as rare or locally endemic. However, they have wider distribution areas. A positive trend is noted: only 4% of the Malagasy reptilian fauna are categorized as threatened.

Since the implementation of the Durban vision, the number of species represented in the protected areas has increased. At the beginning of the prioritization process (2003), 38 species out of 50 under assessment species were known to be found in protected areas. At the current stage of the creation of the new protected areas, all the 50 assessed species are included into the Madagascar Protected Areas System. (Source: Rebioma database, 2009).

D.2.3. Birds

There is no recent discovery for bird species: the last ones are *Cryptosylvicola randrianasoloi* (Goodman and al., 1996a), *Hypositta perdita* (Peters, 1996)' and *Calicalicus rufocarpalis* (Goodman and al., 1997). These new species represent about 2% of the total number of terrestrial species. Some erratic species (Langrand, 1995) come occasionally in Madagascar and contribute to the increase of bird species richness. The integration of the Mikea forest (southwestern part of Madagascar) in Madagascar's Protected Area System gives a legal conservation status to two endemic bird species: *Monias benschi* and *Uratelornis chimaera*.

D.2.4. Mammals

During the last fifteen years, knowledge on the biology, distribution, taxonomy, physiology, and the origins of Malagasy mammals has significantly improved. Some additional forms are being described.

a) Small mammals

There has been clear improvement in the definition of the species' limits for small mammals, especially for two well-represented genera, *Microgale* and *Eliurus:* During 15 years, 12 species of small mammals had been described, and recent findings show that there is an increase rate of 20% for new species. In addition, two new genera of rodents were named: *Monticolomys* and *Voalavo* (Carleton and Goodman, 1996; 1998). Information on species distribution, ecology, and vital areas for the country's rodents and afrosorides are assessed through ecological studies (Ryan and al. 1993; Soarimalala, 1998). In addition, due to significant progress on understanding the origins and phylogeny of Madagascar's mammals, some changes have occurred on the taxonomy of Malagasy small mammals for the higher taxa. Tenrecidae, which was grouped in the order of Insectivora and Liptophyla are now considered in a set of African radiation of mammals of the order of Afrosorides (Bronner & Jenkins, 2005). In addition, the island's indigenous rodents are placed in the family of Nesomydae with a single Malagasy radiation represented by the sub-family of Nesomyinae (Musser & Carleton, 2005).

Peterson and al. (1995) identified 29 species of bats in Madagascar. However, knowledge on Malagasy Chiroptera species richness has been improved; endemic species new to science have been described over the past years. Currently, 38 species grouped in eight families have been inventoried in Madagascar (Goodman and al., 2008a; 2008b), a 29% increase of new species number. Out of the 38 species, 24 are endemic to Madagascar. In addition, over the past years, the biological inventories of bats help solving taxonomic issues or understanding aspects related to ecology and biogeography.

b) Carnivorous

Referred to traditional systematic, Madagascar's indigenous carnivorous fauna is composed by seven species, grouped into two different families: Viverridae and Herpestidae (Albignac, 1973). Since this work was published, a new species of carnivorous has been described, *Galidictis grandidiery Wozencraft,* 1986 (the name was modified by Wozencraft in 1987). In reference molecular analysis, the Malagasy carnivorous are now belong to the endemic family of Eupleridae (Wozencraft, 2005). Recently, some ecological researches have been conducted on Malagasy carnivorous, especially on *Cryptoprocta ferox* (Rasolonandrasana, 1994, Hawkins, 1998).

c) Lemurs

There have been ongoing discoveries of new forms of lemurs since 2005 due to molecular studies (Kappeler and al., 2005; Thalmann and Geissman, 2005; Andriaholinirina and al., 2006; Louis et al., 2006a; 2006b; Yoder and Heckman, 2006; Craul and al., 2007). *Microcebus macarthurii,* (Radespiel and al., 2008) was recently described and other species are in description. The discovery of new species increase the lemur fauna's diversity, which could soon reach up to 100 species or even more if the current trends are maintained. In addition, some threatened lemur species have been downlisted because they are located in the new protected areas. Despite the efforts and the recent discoveries, some species becomes more endangered due to the loss of their habitats. Recent land clearing are mainly caused by lack of governance due to the political crisis in Madagascar (Ratsimbazafy, pers. com.).

E. MOUNTAIN BIODIVERSITY

E.1. STATUS

Mountain humid forests cover significant areas in the eastern part of Madagascar. Though they have low productivity, they have important ecological functions. The main mountains in Madagascar are real water towers for the entire island.

Sites with significant mountain biological diversity are integrated into the existing protected areas. However, more additional sites are strongly concerned by the Government of Madagascar's objective of 6 million hectares of protected areas. The biodiversity of mountains is described in the different sections of taxonomic groups, as part of terrestrial biodiversity.

E.2. TRENDS

Mountain biodiversity is degraded due to anthropogenic pressure as seen in the eastern part of the Betsileo forest corridor: the forest is shrinking to the benefit agriculture, rice-farming on wider surfaces, maize, beans, and more recently, potatoes grown in slash-and-burn cultivation.

Table 11: Deforestation Rate by Altitude

Altitudes	Baseline 90 (ha)	Lost 90-00 (ha)	% per year	Baseline 00 (ha)	Lost 00-05 (ha)	% per year
1200 - 1600	803,583	61,153	0.76	719 ,239	10,807	0.30
1600 +	192,127	7,841	0.41	178 ,049	1,840	0.21

Source: MEFT, USAID and CI, 2009

As seen in this table, deforestation has been significantly decreased since year 2000, and cleared surface area dropping from 28,464ha in 2000 to 9,442ha in 2002.

F. AGROBIODIVERSITY

F.1. STATUS

Agrobiodiversity or *agricultural biodiversity* or *agricultural biological diversity* refers to all the diversity at every level of the biological hierarchy that is involved in agricultural and food commodity production, from genus to the ecosystem. In broad terms, agricultural biodiversity encompasses the varieties and the variability of animals, plants, and microorganisms that are necessary to the functioning of agro-ecosystems, their structures and their processes, all of these contributing together to food production and security.

F.1.1. Plant Genetic Resources for Food and Agriculture (PGRFA)

(Source: Second National Report on the PGRFA's Status in January 2009 of (2) Situation of the Conservation and Use of Agricultural Biological Diversity in Madagascar under Component (2) Agrobiodiversity in June 2006)

PGRFA are composed by species and infra-species diversity of the plant material contained in traditional and improved varieties, as well as wild plants related to cultivated plants that can be used, inter alias, for human and animal food and to obtain fibers, textile, shelter, timber, and fuel wood.

a) Cultivated Plants

According to scientists, Madagascar is not an area of cultivated plants. Almost all agricultural plants species in the country were probably imported by migrating human population in 8th century.

However, Malagasy cultivated plants are characterized by exceptional diversity, which is reflected both (i) at the species level, with plants ranging from temperate-zone plants to tropical plants and Mediterranean-zone species; (ii) at the infra-species level, with the abundance of ecotypes modeled and conserved in a traditional ways by farmers.

The introduction of many plant species from America such as vanilla (*Vanilla fragrans),* maize (*Zea mays*), groundnut (*Arachis hypogeal*), cocoa *(Theobroma cacao*), sweet potato (*Ipomea batatas*), or from Asia such as pepper (*Piper nigrum)*, the banana tree (*Musa spp*), the mango tree (*Mangifera indica*), taro (*Colocasia esculenta*), and rice (*Oryza sativa),* or Africa such as the coffee tree (*Coffea spp)*, vigna (*Vigna spp)*, cowpeas (*Dolichos lablab),* yam (*Dioscorea spp*), facilitated development of new characters of species in Madagascar.

At least 50 cultivated plants have been inventoried in Madagascar. The most widespread include:

- Food plants: grains (rice, maize, wheat, barley), seed leguminous (beans, voandzou, Lima bean, vigna, cowp peas, groundnuts); tubers (cassava, sweet potato, potato, taro); market gardening crops (cucurbitaceae, leafy vegetables, carrots, peas, chayote); spices (ginger, hot pepper, cinnamon, coriander);
- Cash crops: coffee, vanilla, pepper, cloves, sugarcane, tea, cashew, and fiber plants (cotton, raffia, sisal, jute).
- Fruit trees: litchi, banana, pineapple, strawberry, mango, apple, peach, plum, orange, citrus, watermelon, passion fruit;
- Forage plants: grass, leguminous plants.

b) Wild Plants Related to Cultivated Plants

Wild plants related to cultivated plants are species that belong to the same genera as the cultivated plants, but not domesticated. They usually bear potentially useful genes that have been "lost" by cultivated plants (genes resistant to parasites, adaptation to specific conditions, organoleptic quality, etc.) or genes that have new characters during their evolution (no caffeine in the wild coffee trees of Madagascar, accumulation of proteins in the tubers of the wild Ethiopian cassava).

Due to its particularities, the Malagasy flora hosts self-sown plants that are often endemic to Madagascar, such as the wild coffee tree *Mascarcoffea* (about 60 species belonging to the genus *Coffea*), yams (about 30 species of *Dioscorea*), vanilla (six species of *Vanilla*), pepper (six species of *Piper*), arrowroot (eight species of *Tacca*), self-sown rice (two species, *Oryza longistaminata* and *O. punctata*), banana trees (three species, *Musa nana, M. perrieri, M. sapientum*), other fruit-plants such as *Uapaca bojeri* and baobabs (*Andansonia spp.*), Canellaceae (three species, *Cinnamosma fragrans, C. macrocarpa, C. madagascariensis*), a wild sorgho *(Sorghum verticiflorum*), and fiber plants such as *Raphia ruffa.*

F.1.2. Animal Genetic Resources

The animal genetic resources are composed by bovines (zebu), pigs, small ruminants, rabbits, donkeys, ostriches, horses, poultry (hens, geese, turkeys, ducks, etc.) and fish (cf. Biodiversity of inland water).

F.2. TRENDS

F.2.1. Plant Genetic Resources for Food and Agriculture (PGRFA)

(Source: Second National Report on the PGRFA's Status in January 2009 of (2) Situation of the Conservation and Use of Agricultural Biological Diversity in Madagascar under Component (2) Agrobiodiversity in June 2006)

With the various existing threats on agrobiodiversity, PGRFAs inevitably suffer genetic erosion. The current status of the existing diversity remains unknown because no assessment of

PGRFAs' genetic erosion has been conducted in Madagascar. Therefore, it is difficult to assess changes. However, regarding food plants, consumers are aware of such changes, with for example the round and juicy tomato variety becoming rare and replaced by the oval and fleshy variety.

For rice, the preliminary missions to assess genetic erosion were carried out by FOFIFA from 2001 to 2003 in the Highlands and in the Middle West of Madagascar. Due to the lack of resources and the vast territory to be covered, the activity was postponed. However, it appeared that the Botry population as well as Rojomena population tended to disappear. For Rojomena, its sensitiveness to pyriculariosis due to intensive farming reduced its cultivation on the highlands, though its taste is much appreciated. In addition, it was noted that Botojingo and Java in the northwestern coastal areas were also disappearing due to the lack of water control. In the Northwest, West, and Southwest of Madagascar, rice yellow mottle virus (RYMV) which is strong during the rainy season causes the loss of traditional rice varieties.

For cassava, the variety Pelamainty of Taolagnaro has completely disappeared due to drought and the variety Resavoa that is drought-tolerant spread in all the main producing areas. Ascochytosis rust, and anthracnosis can cause the disappearance of some bean varieties.

The genetic erosion affecting coffee trees is quite special, because it is due to inappropriateness of the species in cultivation and the lack of care. Indeed, 100 accessions out of 256, i.e. 39%, and five species (*C. campaniensis*, *C. arnoldiana, C. rostandii, C. tricalysioides, and C. humbertii*) have completely disappeared within 20 years.

The following table shows severe decrease of some PGRFAs genetic diversity over the past 10 years in Madagascar.

Table 12: Loss of Diversity in ex situ collections

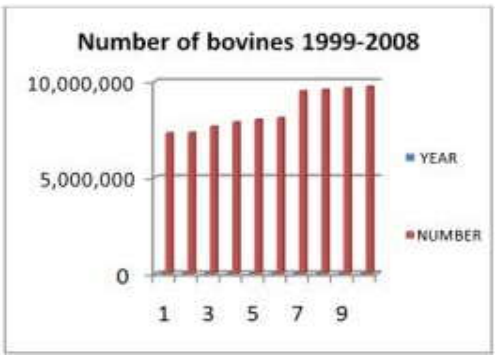
	1996	2006
Cassava	330	202
Groundnuts	349	275
Beans	321	222
Vigna	135	98
Soya	272	Given up
Barley	34	Given up
Pepper	195	Given up
Sugar cane	338	Given up

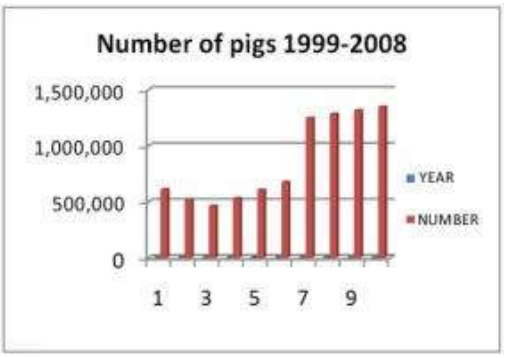
Source: DRA /FOFIFA, 2009

F.2.2. Animal Genetic Resources

The following graphs show the change in the size of each animal species population over the past 10 years. Bovines are the main animal genetic resources in both economic and social terms. As seen in the graph, the bovine population is slightly increasing. Its use is limited (15%). Indeed, given the embargo, its meat goes only to the local market. As regards milk production, an improvement is noted in terms of productivity with the introduction of new races for a total number of 2,900 individuals. However, cattle-raising remains at a traditional stage and is extensive (85%). The average meat consumption is of 5.4kg/individual/year (Rakotondravao, 2009).

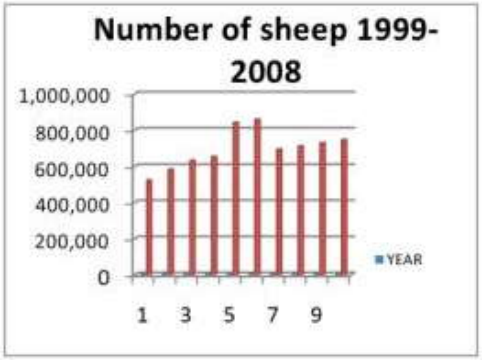
Chart 1: Number of Bovines and Pigs, 1999-2008

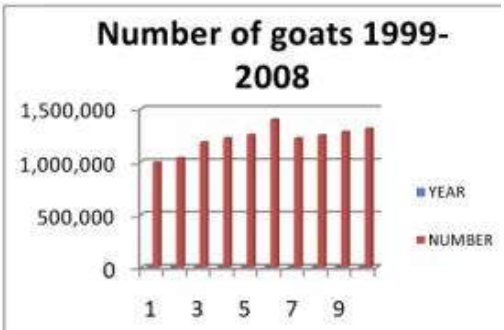




As regards the porcine livestock, losses have been recorded over the past 10 years. The mortality is due to swine fever that has been affecting the country since 1998. The disease has become endemic and is resurgent every year.

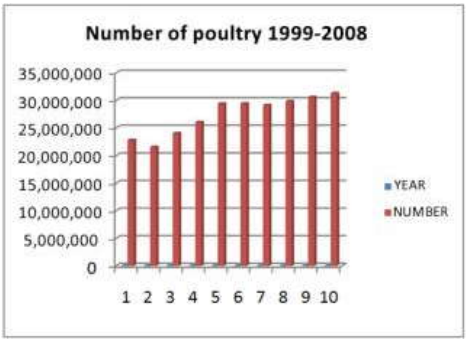
Chart 2: Number of Sheep and Goats, 1999-2008





The population of small ruminants has varied due to exports over the last past years. However, genetic improvement is planned with the introduction of new races.

Chart 3: Number of Poultry, 1999-2008



Poultry-raising is slowly progressing with no major problem. However, it remains at an extensive stage.

II. BIODIVERSITY IN LENTIC AND LOTIC WATERS

The data on the inland water biodiversity was collected in lentic and lotic habitats. Lentic sites (lakes, marshes, swamps) represent 0.3% of the total land area and are composed by 3,429 sites of open water covering 2,000km². Lotic habitats (rivers and streams) are located at altitudes ranging from 800m to 1,400m, subdivided in six major basins of various significance (North-East, Ambre

Mountain, Tsaratanana, the eastern side of the island, the western side, and the southern side), and which are subdivided into 256 basins covering a total length of 3,000km (Ministry of Water, 2009).

A. STATUS

A.1. AQUATIC PLANTS

Based on the hygrophilia gradient, aquatic plants can be classified as heliophytes (semi-aquatic plants that can bear long period out of the water) and hydrophytes (plants that require water at all times, some of which being emerged floating plants or free-floating plants).

The Malagasy aquatic flora belongs to the branch of Pteridophytes in the classes of Filicopsda, Lycopsyda, and Sphenopsida, and to the branch of Spermaphytes in the classes of Liliopsida and Magnoliopsida. In the class of Liliopsida, the families include 92 genera and 284 species. The family of Cyperaceae has the most aquatic species, such as *Cyperus madagascariensis.* No family of Malagasy aquatic plants is endemic except for the species *Schlleropsis lutea* that belongs to the family of Pontederiaceae. It is typically found in streams and ponds in the western part of Madagascar.

Picture 2: Mahavavy Kinkony. by Conservation International

A.2. DECAPOD CRUSTACEA

Most of the Malagasy decapod crustacean species are euryhaline: adults settle in freshwater while larvae develop in brackish water. The larval developments of some species such as Macrobarchium lar occur fully in sea water.

In the group, there are the Astacoures which includes crayfish, the Brachyoures or crabs, the Natantias which include Atyides or shrimps (26 species distributed over four genera: Atyoida, Caridina, Parisia, and Typhlopasta; Caridina alone has 21 species and Parisia has four species). The Malagasy shrimp species that live exclusively in freshwater include both endemic species – with a high micro-endemism level in some cases – and species with wide geographical distribution that may include the entire Indo-pacific region. The rate of endemism of Malagasy Atyidae is about 77%.

Crayfish or Astacoides are one of the groups with high endemism in Madagascar. None of their species is found at the natural state either on the African continent or the Indian sub-continent.

There are currently seven endemic crayfish species in Madagascar: *Astacoides granulimanus, A. crosnieri, A. madagascariensis, A. betsileoensis, A. petiti, and A. hobbsi,* the last one being described recently.

A.3. INSECTS

The following table summarized the species richness and endemism of aquatic insects inventoried under the program "Biodiversity and Biotypology of Malagasy Freshwater".

Table 13: Total Number of Species and Endemic Species of Aquatic Insects

	Taxonomic levels					
	Families		Genera		Species	
	Total	Endemic	Total	Endemic	Total	Endemic
Ephemeroptera	10	0	27	15	168	166
Odonates						
Anisoptera	4	0	39	0	84	21
Zygoptera	5	0	17	1	108	89
Plecoptera	1	0	1	1	12	12
Diptera						
Simuliidae	1	0	1	0	37	30
Tipulidae	1	0	36	0	211	199
Culicidae	1	0	10	1	118	76
Trichoptera	17	0	47	5	516	490
Megaloptera	1	0	2	0	3	3

Source: CNRE/IRD (ex-ORSTOM)/LRSAE, 1996

Endemism is especially high at the species level. Knowledge on the endemic species of Malagasy aquatic insects needs to be updated: last data were collected in 1996.

A.4. WATERBIRDS

The Malagasy waterbirds have 132 species, including 16 threatened species (IUCN Red list, 2009). 65 out of them are migratory species; within it 31 species are regular visitors in Madagascar. 32 species are mainly sea species and most of their visit in Madagascar is rarely. Two migratory species that nest in Madagascar are threatened: *Glareola ocularis* and *Ardeola idea*. These two species migrate to the Indian Ocean islands, and eastern Africa, mainly Mozambique, Kenya, and Tanzania, with a high concentration from April to October in these countries' wetlands (Stevenson and Fanshawe 2003). One important point for the Malagasy bird fauna is the rediscovery of the species *Aythya innotata* (onjy) which was critically endangered, in the wetlands of Bemanevika, in the North of Madagascar.

Picture 3: Discovery of Aythia innotata (Onjy) in the wetlands of Bemanevika. By: Lily René de Roland

A.5. FRESHWATER FISH

The knowledge on Malagasy freshwater fish has a great improvement over the last decade. More than one hundred endemic fish species are currently known.

The freshwater ichtyologic fauna is characterized by the low number of species (compared to the African continent), its endemic species, its sea origin, and the abundance of euryhaline species, specifically in the western part of the country (family of Atherinidae, Mugilidae, Siluridae, and Gobiidae). Among the 154 freshwater species, 111 are endemic within 16 families. Cichlichidae is the most represented with 39 species, followed by Bedotidae with 32 species. For orders, half of the Malagasy Teleosteans are among the Perciforms while the Atheriniforms represent 28 % and the Ciprinodontiforms 12%. The distribution areas are limited and inaccessible except in the lower streams.

A.6. REPTILIANS

There are four species of freshwater tortoises in Madagascar. Three species are indigenous while the fourth one *Erymnochelys madagascariensis* is endemic and critically endangered. The Malagasy Nile Crocodile sub-species, *Crocodilus niloticus madagascariensis* is endemic and is more threatened because of its overexploitation. It is now considered as vulnerable by IUCN.

B. TRENDS

B.1. CRAYFISH

Since 2006, two species of crayfish have become threatened: *Astacoides crosnieri* and *A. petiti*. They tend to live in high altitude where water remains clean.

B.2. AQUATIC INSECTS AND FLORA

As long as there are not enough data on these taxa, it will be difficult to assess the trends of their species. However, the increased of invasive species may result in decrease of their number and increase of their hybridization.

Regarding habitat, trends are rather negative and losses are irrecoverable, because restoration is not possible for this ecosystem, with risk of loss in genetic diversity. Trends are also negative on the socioeconomic viewpoint with a decrease in fishing resources. However, it should be noted that the degradation is starting to slow down with the alternative activities and awareness-raising efforts being implemented, and the upholding of local rites and culture that relate to water could be a mean to conserve inland water species.

Picture 4: Lake Ankomakoma, Ankarafantsika National Park. By: DWCT

B.3. WATERBIRDS

The following table summarized the status, distribution, and population sizes as well as the respective trends of threatened water bird species in Madagascar.

Table 14: Trends and Conservation Status of Threatened Water Bird Species

Species	Status	Distribution	Population	Trends
Tachybaptus rufolavatus CR	Resident	N Central Madagascar	0-10	Declining / extinction
Tachybaptus pelzelnii VU	Resident	Madagascar	5 000	Declining
Ardea humbloti EN	Resident	W Madagascar	1,000-3,000	Declining
Ardeola idae EN	Migratory	Madagascar, Aldabra, Europe	2,000-6,000	Declining
Threskiornis bernieri EN	Resident	Madagascar	1,200-2,500	Declining
Anas bernieri EN	Resident	W Madagascar	1,500-2,500	Declining
Anas melleri EN	Resident	E & Central Madagascar	2,000-5,000	Declining
Aythya innotata CR	Resident	N Central Madagascar	20	Declining
Sarothrura watersi EN	Resident	E Madagascar (5 localities)	250-1,000	Declining
Rallus madagascariensis VU	Resident	Madagascar (E & Highlands)	2,500-10,000	Declining
Amaurornis olivieri EN	Resident	W Central Madagascar	250-1,000	Declining
Glareola ocularis VU	Migratory	Madagascar (E coast Africa N Mozambique N to S	5,000-10,000	Declining

		Somalia)		
Charadrius thoracicus VU	Resident	S & W coast Madagascar	3,100	Stable
Falco concolor	Migratory	W Madagascar		Unknown
Gallinago macrodactyla NT	Resident	E Madagascar	162,000-	Data deficient
Limosa limosa NT	Migratory, rarely visiting	NW & W Africa:	183,000	Declining

Sources: Wetlands International. 2006, The Peregrine Fund Madagascar Project, DWTC, and Asity Madagascar

B.4. FRESHWATER FISH

The following table shows the changes in the conservation status of fish species that are still stable in IUCN's categorization. It should be noted that the data are not yet sufficient.

Table 15: Conservation Status of Threatened Fish Species

	2001	2004	2005	2007	2008
Critically endangered	12	12	11	12	12
Endangered	45	13	18	12	13
Vulnerable	13	29	28	26	24

Sources: CAMP 2001, Global Fish Assessment 2004 and IUCN Red List 2007-2008

B.5. REPTILIANS

The endemic freshwater tortoise *Erymnochelys madagascariensis* remains critically endangered and requires active conservation of its habitat as well as protection of adults and nests.

For the Malagasy endemic crocodile sub-species *Crocodilus niloticus madagascariensis,* its population is declining and has disappeared from most of its habitat. This calls for strict and sustainable regulations on international trade.

III. MARINE BIODIVERSITY

A. STATUS

Madagascar, the "continent island", is one of the biggest islands in the world. Its coastal areas, as an interface between land and sea, represent more than 51% of the country's land and hold about 65% of the total population. With 5,600km of coastline, the coastal areas is composed of natural environments among the richest and the most diversified in the Indian Ocean region, including coral reefs, mangroves, phanerogam seagrass beds, estuaries, and coastal marshes. These environments have relevance for both local community and the international scientific community. The Malagasy continental shelf, between -20 and –250m, stretches over 117,000km² and contains ecosystems and resources with high ecological and economic interest for coastal population and the country as a whole. Madagascar's exclusive economic zone is under the influence of several major ocean currents, bordered at the North and South of the country by two major marine ecosystems that are especially productive, "Somalia" in the North, and "Agulhas" in the South.

Out of the 5,600km of coastline, 1,400km are covered with coral reefs with a total surface area of 2,400km² (Cook and al., 2000). The coral reefs are mostly located in the southwestern, northwestern, and northeast coasts. In the coral reef complex of Toliara (Southwest), 130 species of scleractinial corals, and 700 fish species were inventoried. It is estimated that, there are 200 coral species and 1,500 fish species for Madagascar as a whole (Spalding and al., 2001). 385 fish species,

235 mollusc species, and 164 hard coral species were identified by the marine inventory in Andavadoka (Harding, 2006).

A.1. CORAL REEFS AND MANGROVES

The studies carried out in the North-West (McKenna S.A. and G.R. Ale, eds. 2003) identified 318 species of coral, including seven new species. The number of coral species for the entire western Indian Ocean is estimated at 340. In addition to corals, 525 mollusk species were also inventoried; this richness is close to the "Coral Triangle" diversity, considered as the center of global marine diversity in the Indo-Australian region. In the same area, 463 species of coral fish were recorded with two new species in the family of Pomacentridae. The results of this study and literature review showed that there are 752 coral fish species in Madagascar.

Madagascar's mangroves are from Indo-pacific phytogeographical origin and include eight species of mangles belonging to the families of Rhizophoraceae, Avicenniacea, and Sonneratiaceae. Most of the mangroves are found on the western coast, from Antsiranana to Toliara in the South. Their surface area is estimated at more than 320,000ha, with 98% on the western coast. The biggest mangroves stretch over 30,000ha and they are associated with major rivers such as Mahajamba, Loza, Bombetoka, Tsiribihina, and Mangoky. On the eastern coast, their surface area doesn't exceed 2,500ha, and located in the North-East between Antsiranana and North Mananara.

In the North East, in the sea park of Nosy Atafana, 179 fish species, 132 coral species, 63 mollusk species, and 34 echinoderm species were inventoried.

A.2. MARINE MAMMALS

The diversity of Malagasy marine mammal is represented by 28 species, including 27 cetacean species, and only one species of the order Sirenia, *Dugong dugon*. To date, the spotting of 15 cetacean species, including three mysticetes, and 12 dolphin species (Odontocetes) has been confirmed. It is assumed that other cetacean species, including four whale species and eight dolphin species, use the Malagasy sea given their presence in the Indian Ocean region. Studies conducted in sites on the western coast, between Anakao, Andavadaoka, and Nosy Be confirmed the presence of 14 species of marine mammals. As for the three other sites of the eastern coast (Bay of Antongil, Sainte Marie and Taolagnaro), a total of seven species were recorded.

Table 16: Marine Mammal Species Observed in the Western and Eastern Coasts of Madagascar

Species	Western coast	Eastern coast
Dolphin	1- *Sousa chinensis* ; 2- *Tursiops aduncus* ; 3- *Tursiops truncatus*); 4- *Stenella longirostris* ; 5- *Stenella attenuata* ; 6- *Grampus griseus* ; 7- *Globicephala macrorhyncus* ; 8- *Peponocephala electra* ; 9- *Pseudorca crassidens* ; 10- *Physeter macrocepahlus*	1- *Tursiops aduncus* ; 2- *Tursiops truncatus* ; 3- *Stenella attenuata* ; 4- *Lagenodelphis hosei*
Whales	1- *Megaptera novaeangliae* ; 2- *Eubalaena australis* ; 3- *Balaenoptera sp*	1- *Megaptera novaeangliae* ; 2- *Eubalaena australis*
Dugong	*Dugong dugon*	*Dugong dugon*

The sea mammals encountered in Madagascar are listed in IUCN's categories. The blue whale is critically endangered (EN), three species, namely the hump-back whale, the sperm whale, and the dugong are vulnerable (VU). Five species of dolphins (Indo-pacific bottlenose dolphin, common bottlenose dolphin, hump-backed dolphin, Fraser's dolphin, and Risso's dolphin) are categorized as data deficient (DD) species. The other marine mammal species are considered as low risk (LR). It should be noted that some dolphin species included in the data deficient category, especially the hump-backed dolphin, and the bottle-nose dolphin are vulnerable to anthropogenic activities such as hunting and accidental catches in the coastal areas of southwestern Madagascar.

A.3. SHARKS AND RAYS

Sharks as flagship species are the first regulating link of the aquatic biodiversity due to its role in the marine trophic chain. The very recent study on sharks in the islands of western Indian Ocean (Kiszka and al., 2009) showed the presence of 83 species of elasmobranches in Madagascar's marine area. This diversity represents 8.4% of the fish species in Madagascar, with a total of six endemic species.

A.4. TURTLES

Five marine turtle species are known in Madagascar, *Dermochelys coriacea*, *Lepidochelys olivacea*, *Chelonia mydas*, *Caretta caretta*, and *Eretmochelys imbricata*. In terms of relative abundance, the green turtle (*Chelonia mydas*) is the most frequently spotted, followed by the hawksbill turtle *(Eretmochelys imbricate*), and then the loggerhead sea turtle (*Caretta caretta*) is rarely seen.

B. TRENDS

The results of the studies in the northwestern part of the country (McKenna SA and G.R Allen, eds. 2003) show that 55 coral fish species are targeted by local fishermen. It was noticed over several years that the stock of sharks seems to be declining. Sea cucumber species with high commercial value become rare. During the study, the coral sites that were monitored appeared to be in good condition. The most frequent causes of degradation are related to *Acanthaster planci*, a predator of corals, especially in some localized areas.

Picture 5: Marine wealth in Ambodivahibe. Photo by Conservation International

Part II. Threats on Biodiversity

Threats on the Malagasy biodiversity are diverse and intense. Madagascar is one of the global hotspots[1] and shares the issue of environmental degradation common to tropical countries with high biodiversity potentialities. Anthropogenic causes are the most determinant because a large proportion of the population relies permanently on natural resources for their livelihoods.

I. MAIN THREATS ON BIODIVERSITY

A. DEFORESTATION, FOREST DEGRADATION, AND FRAGMENTATION

The Malagasy terrestrial biodiversity has an exceptional diversity with a high level of endemism. Thus, the loss of forest cover is a serious threat to fauna and flora species. Due to high concentration of biodiversity in restricted areas, the loss of one hectare of forest is more serious in Madagascar than anywhere else in the world. This threat persists to date though a decrease in the rate of forest cover loss has been noted over the past years.[2] Thousands hectares of forest are destroyed and are replaced by wide open habitats that are quickly colonized by weeds and secondary pioneer species.

B. SHRINKING OF LAKES AND MARSHES AND FRAGMENTATION OF STREAMS

The terrestrial freshwater biodiversity is mainly found in lakes, marshes, streams, and rivers and have often precarious existence. Lakes and marshes are shrinking and becoming shallower (during the low-water period, Lake Alaotra's depth is reduced to 60cm). Similarly, almost all western side rivers run dry during the low water period and silting is such that the rivers overflow their paths during the rainy season. This situation results of the combined effects of anthropogenic actions (deforestation, bush fire) and natural phenomena (climate variations, high concentration of rainfall).

C. CHANGE IN MARINE ENVIRONMENT

Madagascar has 5,600km of coastline, one of the biggest coral reefs in the world, and mangroves that provide tremendous ecosystemic services. The Bay of Antongil and the canal of Sainte Marie are whales' breeding areas. The marine environment is affected both by telluric pollution and the effects of climate change. Those two factors can cause tangible changes on the sea flora, on mangroves, and on coral reefs, which in turn cause changes in the composition and balance of marine fauna.

D. BIODIVERSITY EROSION

Biodiversity erosion consists in gradual and irreversible impoverishment of the biological diversity, whether in the plant or animal kingdom. While knowledge of species is constantly increasing, some species are critically endangered (cf. IUCN Red List 2008); others are assumed to be extinct. Such extinction results from the combined effect of anthropogenic causes.

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[1] The classification takes into account both the richness of biodiversity and the level of pressure on biodiversity.

[2] The overall deforestation rate in Madagascar was 0.82% in the 1990's and decreased to 0.55% during the 2000-2005 period. Though lower than the global rate for tropical forests, this level of deforestation is of a special concern in the case of Madagascar where the natural forest cover is less than 12% of the total land surface area. The deforestation rate remains high for spiny forests at 1.1% per year, while the rate for rainforest has been decreasing from 0.79% to 0.35%, and the rate for dry forest from 0.70% to 0.42% per year. (Source: Conservation International 2007).

II. THE DIRECT CAUSES OF THREATS

A. AGRICULTURAL EXPANSION

Agricultural expansion is revealed in two ways: conversion of forests into farmlands and transformation of water bodies and marshes into rice fields. The conversion of forests into farmland through clearing is often followed by burns. This process known under the local names of "*tavy"* or "*hatsake*" is practiced by households living on the border of forests for their livelihoods.

The highest population growth rates in Madagascar are observed in rural areas (80% of the households). Rural households live by valorizing natural assets, including the land. When the population grows, needs for farmland increases in order to meet the basic needs. In areas bordering forests, needs for more space are met through shifting land clearing. Farmland increased because of forest areas conversion.

The reduction and degradation of natural habitats as well as the forests fragmentation are the main factors for the loss of many herpetofauna species and the decline in the populations (Ramanamanjato 2008, Rasellimanana 2008b). The threat is especially high for species that have very specific ecological requirements or a restricted range species, such as Furcifer belalandaensis, Lygodactylus mirabilis *and* L. blancae.

B. EROSION AND SEDIMENTATION

Deforestation on highlands and catchment basins increases erosion in a dramatic scale. Runoff water wears off the parent rock and carries sediments downstream to estuaries. Thus, erosion increases the sandy component of estuaries' sediments and reduces the colloidal portion. After catchment basins deforestation, the soil in cleared areas becomes eroded after leaching with rainwater. Sediments are transported by rivers to the sea. During this trip, solid particles gradually silt when they go through stable areas such as lakes, marshes, and swamps to their way to rivers' mouth. Sediments pile up and mud off, and these areas are silted. The silting of wetlands leads to obstruction and shrinking of water surface area. Sand and lateritic sediments are poor and modify vegetation and lentic biocoenosis.

Picture 6: Lavaka in Ankarafantsika. By: DWCT. Madagascar

C. WILD FIRES

Slash-and-burn and forest fires, which have multiple origins, remain a predominant cause of natural resources destruction in Madagascar. It is known that prairies are burned to renew the grazing land before the rainy season. Some of the fires set by farmers living near forests get out of control and burn forest. In some cases, it seems that the fires are set as a demonstration of unhappiness with the authorities and/or the Government.

The eastern part of the country and the different vegetation of the highlands such as the Tapia forest and the riverine forest in Itremo are threatened by fires. The same threats affect various species of *Phyllantus*, such as *P. betsileanus, P. vakinakaratrae, and P. ivohibeus* (Rafalimanana 2007).

D. INVASIVE SPECIES

In general, the introduction of (stronger) exotic species reduces the habitat of indigenous species. For plants, invasive species easily take over poor and marginal soils. For fauna, competition is always won by exotic species. Thus, the repeated introduction of *Acridoteres tristis* individuals in Madagascar (from 1875 to 1985) and its rapid proliferation is considered as a threat to Malagasy birds, mainly habitats birds (Goodman and Hawkins, 2008). Similarly, the high abundance of the introduced species *Rattus rattus* is a significant threat to the survival of small mammals. In some forest units, when *Rattus rattus* colonized the natural habitat, the populations of some small indigenous mammals as rodents decline.

The introduction of exotic fish species results in changes in the habitat for herbivorous species such as Tilapia macrochir, T. melanopleura, in direct predation by *Micropterus salmonoides* and *Ophiocephalus striatus* and in competition between *Tilapia spp* and indigenous species. Carnivorous species have further aggravated the ecological imbalance among fish populations. Carnivorous fish have well developed in the country's water bodies by eating aquatic insects, batrachians, and local fish. *Heterotis niloticus* (vangolaopaka) seems to colonize the habitat of *Megalops cyprinoides* (besisika) and *Arius madagascariensis* (gogo, vaona). For two years now, the presence of an invasive crayfish species, *Procambarus alleni*, is considered as dangerous because it kills all associated fauna (especially endemic species) and its multiplication is very fast by parthenogenesis. Similarly, the introduction of some exotic plankton-eating, herbivorous, or carnivorous fish species has been was detrimental to some lake bird species by the transformation of its natural habitat, which benefits to some opportunistic bird species. It is the case of *Tachybaptus pelzelnii* (Malagasy grebe) on *Tachybaptus rufficollis* (little grebe).

Finally, the introduction of exotic plants such as *Eichhornia crassipes* (water hyacinth) results in eutrophication of aquatic environments and transformation of freshwater habitats. In most cases, it becomes not adapted to the original fauna such as the case of *Thalassornis leuconotus* (white-backed duck).

E. CLIMATE CHANGE

Over the past fifty years, the average temperature has increased by 1°C, and about 2°C in semi-arid and sub-humid areas in the South (Directorate of Meteorology, 2008). The effects of this change begin to be observed in batracofauna communities in high mountains region (Raxworthy and al., 2008).

Climate change constitutes the main threat for marine and coastal ecosystems. It is more severe than anthropogenic threats. The combined effect of temperature increase and salinity increase would be unbearable to corals, especially those that are already experiencing stress due to anthropogenic actions. This phenomena increases algae's dominance, facilitates the dominance of invasive species and a decreases coral cover. This may lead to a total change in the population of the current coral reef areas, namely a development of herbivorous fish to the detriment of carnivorous

fish. Climate change has caused a decrease in the coral reef coverage and in the cover of phanerogam (Bay of Antongil). The increases in temperature and cyclones have caused the proliferation of other living organisms and a decrease of 30% of living corals.

Marine turtle are highly vulnerable to climate change. Indeed, the rise of the sea level moves away the beaches where the turtles used to lay eggs and more abundant rainfall floods their nests and reduces the hatching rate. The increase in temperature affects sex ratios at hatching (higher temperature increase chances to have female turtles). Indeed, as cold-blooded animals, turtles are affected by temperature in terms of development, maturation, and basic metabolism.

F. INDUSTRIAL DEVELOPMENT

Mining activities lead to habitat fragmentation. While large-scale mining is not shifting, its footprints on forests are huge, especially clearing for mining perimeters access. In general, their impacts zone and the type of impacts are known in advance. Conversely, small-scale mining activities develop with no control, and footprints on forests are multiplied as miners increase in number. Mining impacts on forests are not only due to the extractive activities but also to the precarious human settlements that come with it.

The pharmaceutical Industry constitutes also a threat. Tradipratician's collection was never threatened in situ conservation of medicinal plants, because they just take what they need for local use. When private operators step in, the collect increases and damages may occur. The rapid extermination of *Ravensara aromatic* and *Pygeum africanum* in their natural environment is illustrative of this situation.

Textbox 1: *Are mangroves disappearing?*

Mangroves have multiple uses: fuel wood, timber, medicinal plants, and tannins. In addition, they provide a significant economic role in the coastal world: rice-farming areas, tourist attractions, and shrimp farming areas.

Some species within mangroves will be disappeared by uncontrolled overharvesting of mangroves' products in some areas in the country. In addition, estuaries' silting due to upstream erosion has favored the development of the *Sonnertia alba* species to the detriment of *Ceriops tagal* species which cannot thrive in too sandy silting. Then there are changes in the eco-flora zoning and the ecological balance.

The logging also contributes to the forests degradation. Indeed, loggers do not always follow the written exploitation standards in their logging permit, neither in qualitative terms (species and individuals that can be exploited) nor in quantitative terms (size and amounts exploited). In addition, ecological values of trees are underestimated compared to their economical values. Thus, the extraction of individuals from the forests disturbs the ecosystem's stability and has negative consequences on the genetic heritage of the species logged, the living conditions of other biodiversity elements (other wild plants and animals), as well as physical elements (soil, water sources, etc.).

G. OVEREXPLOITATION

Useful plants are the most threatened by over-collection. This is the case of tinctorial plants (such as *Labourdonnaisia madagascariensis)* whose bark is used by weavers (barked trees die), aromatic plants (such as *Helichrysum spp)* from which essential oils are extracted, causing its rarefaction, and food plants as *Dioscorea spp.* While natural cataclysm damage or cut individuals in a random way, anthropogenic actions aims to get as many products as possible with the best quality as possible. This skimming action results inevitably in genetic erosion that in turn disturbs the biological stability, affecting first the concerned species then the entire biotic community (other plants and animals) to which it belongs.

Hunting and poaching are among the major threats to Madagascar's fauna. In some cases, it is practiced for food purpose such as the Vari lemurs (*Varecia spp.*), Eulemurs (*Eulemur spp.*) and the propithecus (*Propithecus spp.*). The same applies to some amphibian species (Jenkins and al., 2009), especially the bigger species living in water streams (such as *Mantidactylus grandidieri, M. guttulatus, Boophis goudoti)* and to reptilians (the Malagasy big turtle that is found only in the rivers and lakes of the western coast and has disappeared from several regions). Egg collection especially affects some groups of water and sea birds such as *Pledagis falcinellus* and *Sterna fuscata* that have become rare over the last twenty years as well as *Crocodylus niloticus madagascariensis.*

The sharp increase in international demand constitutes another reason. This is the case with nice-looking and colorful amphibian species (10 species out of 15 for *Mantella* spp. and 3 out of 7 for *Scaphyophryne* spp) and the radiated tortoise (illegally exported to La Reunion where its flesh is much prized). Hunting significantly affects the distribution of species and in addition, trap installation leads to partial forest degradation.

Text Box 2: *A dual threat for Madagascar palm trees*

Madagascar is one of the locations with the greatest richness of palms in the world, with 194 species inventoried. In rural areas, palm trees are used for food, for braiding, for construction, and for making utensils (Dransfield and Beentje 1995). In urban areas, palm trees are used as ornamental plants in gardens and parks.

The deforestation over the last decades leads to the disparition of natural habitats for some species such as *Dypsis ramentacea, D. heteromorpha, and D. monostachya* which were collected only in their natural habitats and forests.

In addition, due to overexploitation, many palm populations lost mature individuals, which results later on in the extinction of the species at the local level. This is the case of *Lemurophoenix halleuxii* and *Voanioala gerardii* in the region of Mananara Avaratra, or *Beccariophoenix madagascariensis* in Mantadia and Ampasimanolotra, or *Dypsis ambositrae* in Ambositra. Nowadaways, 142 species of palm trees are threatened in the forests of Madagascar (Rakotoarinivo 2008)

III. THE INDIRECT CAUSES OF THREATS

A. POVERTY

Poverty in the rural world is the main indirect cause of threats on biodiversity. Indeed, 80% of the Malagasy population lives in rural areas and more than 60% of the population lives below the poverty line. This situation explains the very rustic farming modes, the proliferation of survival-level activities that directly impact on biodiversity, such as overexploitation and extraction beyond the species' capacity to regenerate, and even poor governance.

B. HABITS AND CUSTOMS

The land management system is only at a nascent stage in rural areas. Clearing forests therefore appears as they only way to appropriate land, with an acceptation of property rights at local level and from one generation to the next. Paradoxically, this property right is never upgraded into a land title and thus the land asset cannot be valorized as a capital for the rural world or for economic structuring.

Furthermore, habits and customs limit food production to a few numbers of cultivated cereals and related wild species, and lead to the gradual loss of wild food plants.

C. GOVERNANCE GAPS

Gaps in governance make illegal logging and extraction of secondary forest products worse. Control activities are not performed in a right standard and deficiencies are noted in the law enforcement.

Illegal trade constitutes a permanent threat for feathered animals and has a significant level for wild animals. It especially affects species classified in CITES Annex II. *Agapornis cana* is one of the species concerned by this problem. The difference between the number of individuals booked in Madagascar for exportation and the number reported in the recipient countries was of 2,561 individuals.

D. LACK OF SAFEGUARDS

Biodiversity destruction by industrial activities is due to lack of safeguards. In some cases, environmental impact assessments are not comprehensive enough, and sometimes it is omitted. The obligation to restore the environment at the closing of operations is not always complied with.

Domestic and industrial pollution are a heavy threat on Madagascar's water bodies that flow near major agglomerations and on wetlands. The pollution is due to industrial discharges and the use of pesticides for intensive cultivation (tobacco, rice, and cotton). The development of mining activities and implantation of transformation units will certainly result in increased pollution in the wetlands at Toamasina and Taolagnaro.

E. UNSUSTAINABLE PRODUCTION AND CONSUMPTION MODES

Shifting agriculture is not sustainable due to lack of householders farming techniques, farmlands created by forest clearing are used until full depletion. As a result, households are always looking for new farmland. The impact of forests conversion into single-crop fields (even at a small scale) is not limited to habitat loss but also includes a decrease of the ecosystem services provided by the forests in general.

On the other hand, domestic energy supply is essentially fuelwood. Less than half of households' fuelwood needs are met with planted forests[3], and primary forests therefore come as the complement for meeting the needs in charcoal and firewood. The demand for these products is maintained by the high prices of other fuels (gas, oil) and the lack of alternate fuels that are affordable to households. The introduction of other alternate energy sources such as solar ovens runs against deeply rooted customs and habits.

F. DISEASES

Diseases constitute the main threat for animal genetic resources. They are compounded by archaic farming methods (due to the lack of knowledge and resources among farmers). The most frequent diseases are the anthrax-type diseases (anthrax and blackleg), lumpy skin diseases, swine fever (African swine fever and classical swine fever), Marek's disease, and dogs' rabies.

Diseases also affect plant genetic resources. The main phytosanitary diseases inventoried concern market gardening species (20 diseases) and fruit species (10 diseases). Their development (period of apparition and areas affected) is often linked to climate variations.

[3] National needs are estimated at 12 million cubic meters per year. Planted forests produce 4 million cubic meters.

G. LACK OF REGULATORY MECHANISMS

Regulatory mechanisms are lacking. While the law on industrial pollution agrees the principle of “polluter pays”, the modalities for enforcing the principle remain at a nascent stage. In addition, there is no tax incentive for the production of fuel through planted forests, which makes charcoal from natural forests cheaper while having a better heating capacity. Furthermore, taxes on hydrocarbons are so high that households cannot envision switching to these in replacement of fuel wood.

Table 17: Threats on Biodiversity

	Threats	Direct causes	Indirect causes	Consequences
Agricultural ecosystems	Genetic erosion of agrobiodiversity	- Erosion and sedimentation - Diseases -Lack of conservation steps for cultivars and seeds - Invasive exotic species	- Poverty - Lack of scientific knowledge - Inadequate use of local knowledge - Non sustainable production modes - Lack of resources for management	- Decrease in productivity - Food insecurity
Forest ecosystems	-Deforestation, forest degradation - Fragmentation of ecosystems	- Agricultural extension - Slash-and-burn and uncontrolled fire forests -Invasive species - Climate change - Logging - Mining activities - Collection of fuel wood - Overexploitation - Hunting, collection and extraction	- Poverty - Customs and usage - Lack of governance - Lack of safeguards - Unsustainable production modes - Und Underestimation of the value and services from biodiversity - Population growth and increase in population density	- Decrease in the species wealth of ecosystems - Extinction of threatened species - Reduction of ecological services
Inland water ecosystems	- Shrinking of lakes and marshes - Changes in rivers' beds - Drying up of springs - Erosion of aquatic biodiversity	- Agricultural expansion - Invasive species - Pollution - Climate change - Development of infrastructures - Overexploitation - Erosion and sedimentation	- Poverty - Customs and usage - Lack of governance - Lack of safeguards - Non sustainable production modes - Underestimation of the value and services from biodiversity - Population growth and increase in population density	- Decrease in the species wealth of ecosystems - Extinction of threatened species - Reduction of ecological services
Marine and coastal ecosystems	- Deterioration of the environment - Destruction of coral reefs - Clearing of mangroves - Aquatic biodiversity erosion	- Telluric pollution - Sedimentation - Climate change - Infrastructure development - Over exploitation	- Poverty - Lack of governance - Lack of safeguards - Non sustainable production modes - Underestimation of the values and services from biodiversity - Lack of regulatory mechanisms	- Decrease in the species wealth of ecosystems - Extinction of threatened species - Reduction of ecological services

Part III: Impacts of Biodiversity Conservation on Human Well-Being

I. ENVIRONMENTAL SERVICES

Land ecosystems provide tremendous environmental services. They ensure production, regulation, and the other functions related to cultural values.

The following goods and services are provided by production functions of ecosystems:

- Oxygen, food, fodder, and nutrition;
- Biochemical products and nutrients;
- Water for consumption, irrigation, industrial, and pathway;
- Genetic and medicinal resources (flora and fauna);
- Fuel and other sources of energy, including oil and wood;
- Raw materials for building, garments, crafts, etc.;
- Ornamental resources.

Regulation functions of ecosystems are:

- Regulation of runoff from mountain areas, through the plant cover;
- Regulation of floods by river forelands and watermeadows,
- Catchment of water and resupplying of groundwater;
- Protection of dunes, mangroves, and forest borders against flooding;
- Biological control mechanism such as protection of crops;
- Formation of arable soil and maintenance of the soil's fertility;
- Maintenance of biological and genetic diversity (among species and habitats);
- Micro-climate function of forests;
- Forests as carbon traps in terms of global greenhouse.

Text box 3: *Estimation of the Economic Benefits of Conservation*
(Carret, 2002, World Bank, 2005, http://portal.conservation.org/portal)

It is estimated that from 2002 to 2012, the avoided deforestation in Madagascar will ensure the storage of 46.6 million tons of carbon dioxide (CO_2). The overall economic benefit that the country obtained over the last five years through the system of protected areas is about USD57 million for eco-tourism services, and USD80 million for hydrological services (Carret 2002)

Marine and coastal ecosystems strongly contribute to the development of the local, regional and national economy. For example, coral reefs and mangroves that usually contain shrimps represent potential incomes about Euro100 million and 200 million per year. Incomes include environmental services provided by their natural resources. Indeed, coral reefs break waves and thus reduce their impact on the coast and erosion of the coastline.

The Signification functions that are related to cultural values include:

- Aesthetic values (beauty of landscapes and the nature);
- Spiritual an religious values such as with sacred trees and forests;
- Historical and cultural values;
- Scientific and educational values.

II. SOME USES OF THE PLANT RESOURCES FOR HUMAN WELL-BEING

Biodiversity has major impacts on human well-being. In Madagascar, about 70 to 75% of the population directly depends on plant resources – mainly farmers and communities living in forests but also workers involved in crafts, with many women among them. The number of species inventoried in Madagascar is 1,091.

Table 18: Uses and Biologic Diversity of Useful Plants in Madagascar

	Number of useful species
Fuel wood	74
Timber	125
Grains and dry beans	29
Coloring agents and tannins	56
Spices and condiments	34
Fruits	38
Essential oils	35
Vegetables	118
Oleaginous plants	25
Fiber plants	77
Forage plants	101
Medicinal plants	236
Ornamental plants	92
Stimulant plants	14
Carbohydrates (sugar and starch)	37

(Source: PROTA database)

A. HUMAN FOOD

Wild Human foods are composed by three types of products: forest tubers, palm trees, and wild fruits.

Forest tubers are used as security food by communities living near forests, especially during the lean period. The most consumed species belong to the genus *Dioscorea* (at least 15 edible species).

For palm trees, the most savoured parts are the terminal bud and the heart (palm cabbage). The most used species are *Dypsis basilonga*, *Borassus madagascariensis*, *and Marojejya insignis*. However, other organs such as young shoots and fruits are edible in some species (*Dypsis baroni* and *D. utilis*). The fruits and terminal buds of some species such as *Hyphaene coriacea* and *Dypsis decaryi* are fermented to obtain alcoholic beverages.

Forest fruit species improve the nutritional quality of farmers' food rations by providing sugar and trace elements.

CASE STUDY 1: Yams in the Fandriana-Vondrozo corridor, in Fianarantsoa

(Source: RBG Kew, FBM-NT and University of Antananarivo, 2007)

Yams are found in the open habitats of the corridor. During the lean period, local communities have no more rice to feed and yams are the only edible plants available. To survive, local population collects tubers of cultivated species and wild species.

According to surveys among 700 households, *Discorea alata* and *Discorea bulbifera* are the two main yams cultivated and widely used in the region while *Dioscera kimiae* and *Dioscera seriflora* are abundantly found in the wild.

In order to maintain the corridors' richness in yams, a project for conservation and sustainable use of yams was initiated in 2007 by the RBG, in partnership with FBM-NT and the University of Antananarivo.

B. PRODUCTION OF WOOD AND FIBERS

High quality of timber trees such as Dalbergia (30 species with at least five endemic, Ocotea (3 endemic), Khaya madagascariensis, Commiphora spp, Calophyllum chapelieri and Diospyros spp. (palisander, ebony, rosewood, etc.) can be found in Malagasy forest

As regards non-wood products, the rural population also uses Raphia spp, Bismarckia nobilis, and Ravenala madagascariensis for building, braiding, ropes, and clothing. The table below shows the use of some forest species.

C. USE OF MEDICINAL PLANTS IN PUBLIC HEALTH

More than 60% of the population use medicinal plants (forestry or self-sown species), given the scarcity and the cost of imported drugs (cf. Chapter 3). About 35% of the medicinal plants in use are endemic.

The use of medicinal plants is reflected by the volume of products sold on local markets. This trade is essentially informal, so there is no comparison between traditional use and exportation. The annual consumption is estimated at 4,000 tons of raw plants, out of which about 150 tons come from a pool of 20 plants.

Industrial exportations are composed by 50 species, out of which, 30 are from forests and 35% are endemic species. The annual amounts range from 30 to 1,300 tons, mainly of dried raw plants but rarely of raw extracts. While they are considered as accessory forest products, medicinal plants are actually resources with huge financial and scientific potentialities: they are used for their active principles or as a source for chemical molecules (database of the Flora Permanent Secretariat, 2009).

D. ORNAMENTAL PLANTS

The trade of ornamental plants is one of the Malagasy people's sources of income. The most marketed ornamental plants are classified in four groups: orchids, palm trees, succulent plants (*Adenia spp., Aloe spp., Alluaudia spp., Commiphora spp., Cyphostemma spp., Delonix spp., Didierea spp., Euphorbia spp., Kalanchoe spp., Operculicarya spp., Pachypodium spp., Senna spp., Uncarina spp.,* and *Zygosicyos spp., etc.*), and water plants, particularly Aponogetons.

Exportation of ornamental plants is under the CITES regulation. There currently 20 licensed horticultural operators (Database Flora Permanent Secretary, 2009) and the exported plants come essentially from their horticultural centers. The following table shows the volume of main exported species:

Table 19: Exports of some Species Extremely Valuable Commercial Species (kg).

Species	Nature	2000	2001	2002	2003	2004	2005	2006
Aponogeton fenestralis	bulbs	61,250	14,200	8,800	20,864	30,220	17,150	11,755
Aponogeton henkelianus	bulbs	13,710	18,850	21,665	17,470	25,960	23,000	9,600
Euphorbia itremensis	plants	0	0	0	0	829	543	225
Pachypodium brevicaule	plants	207	490	0	505	1,814	1,279	1,628
Pachypodium densiflorum	plants	33	235	3	514	942	1,825	1,191

Source: Evaluation of the national policy related to the trade of wild species to support CITES, 2008.

These five species are traded by all the specialized operators, given their price in the international market. In addition, each operator requests to collect 5,000kg of *Bismarckia nobilis* and 6,000kg of *Ravenea rivularis* per year. (Database Permanent Secretary Flora, 2009).

III. SOME POSITIVE EFFECTS OF THE CONSERVATION OF SOME FAUNA SPECIES

Fauna plays an important role for human well-being (main source of animal proteins, disease control, source of income, cultural values attributed to species, etc.), ecotourism, and ecosystem balance. The two following paragraphs highlight some positive effects derived from the conservation of amphibians and chameleons.

A. AMPHIBIANS

Amphibian biology and ecology required specific habitat and consequently sensitive to any habitat alteration (water and forest's health) and climate change (cf. Raxworthy et al. 2008). The Malagasy frog can contribute to reduce malaria and schistosomiasis as they eat mosquitoes and larvae. It could be a tremendous source of animal protein if it use in sustainable ways. Given their attractive looks and colors, amphibians are exported under the CITES control. In addition, many species contribute to the dissemination of flora, including fruits and medicinal plants.

B. CHAMELEONS

Chameleons are relatively well-known and are appreciated by the general public in Western Europe, the USA, and throughout Asia. Madagascar makes profits from the international trade of chameleons (Raselimanana, 2003); however, since 1995, the CITES has suspended exports for all chameleons from Madagascar, except four species of *Furcifer* that have a large distribution area (Carpenter et al. 2005).

Chameleons can potentially contribute to social and economic development for three reasons:

- They attract tourists in Madagascar because they are outstandingly featured in advertising campaigns, websites, and natural history television programs;
- They may serve as flagship species to attract financial support for the creation and protection of protected areas;
- Their income generated from legal and sustainable export of certain chameleon species could be used to support local communities and conservation actions. This is however not yet apparent in Madagascar where the only beneficiaries of the chameleon trade are the collectors, exporters, and the government.

IV. IMPACT OF CONSERVATION ON TOURISM

Tourism is the third source of currencies for Madagascar. The natural biodiversity capital is the main product for the country's touristic development. Up to 60% of the recorded visitors in Madagascar are for tourism purpose. They enjoy the beach as well as parks, so it difficult to make distinction between nature tourism and ecotourism.

Undoubtedly, the tourism sector has significantly developed itself in the recent years and its effects have reached the sectors of infrastructures, transportations, education, rural development, and even internal security. For example, in some localities such as Ranomafana, Andasibe, Ranohira, or Maroantsetra, local livelihoods depend on tourism and other touristic sites, such as Nosy Be or Sainte Marie are considered as regional growth poles.

Table 20: Trends of the Tourism Sector from 2002 to 2007

	2002	2003	2004	2005	2006	2007
Arrivals at the border	61,600	139,200	228,700	277,000	311,700	344,300
Number of tourists	36,960	83,520	137,220	166,200	187,020	206,000
Number of visits in protected areas	21,340	88,160	101,102	106,700	108,300	113,000
Receipts in currencies (millions of DTS)	27.8	54	105.3	124.5	157.7	211
Capacity of accommodation (rooms)	8,700	9,300	10,200	10,800	11,800	13,300
Jobs directly created	17,600	18,600	19,850	21,160	22,480	24,360

Source: Ministry of Tourism, 2008

Picture 7: Tsingy of Bemaraha, by Madagascar National Parks

CASE STUDY 2: Evaluation of the Economic Impact of Whale-Watching Ecotourism in the Marine Areas of Madagascar

Although the marine areas of Madagascar count 16 species of cetacean, the humpback whale is the most appealing for cetacean commercial watching. Every year, from June to November, thousands of humpback whales migrate in Malagasy coastal areas to breed. With their fascinating courtship displays, they offer an unforgettable experience to watchers. A study to evaluate the economic impact of whale watching for years 2007 and 2008 was conducted in Madagascar. The information collected from the study provides a means of protesting against whale hunting.

The whale watching industry has known significant growth in Madagascar, with an average individual investment growth of 14.8% according to the table on the growth of the whale watching activity. This increase probably derives from the overall development of tourism in Madagascar at the individual investment growth rate of 13.2%. During the 2008 season, whale watching in the nature generated a total of 197 jobs for the coastal communities of Madagascar and brought foreign currencies equivalent to approximately USD1, 825,628 in the coffers of the State.

Tableau 21: Growth of the Whale Watching Industry in Madagascar

Year	Number of whale observers	Number of operators	Direct expenditures (USD)	Indirect expenditures (USD)	Total expenditures (USD)
1998	4,000	12	120,000	554,000	774,000
2008	15,928	41	814,495	1, 011,533	1, 825,628

Source: WCS, 2008

The political crisis in 2009 can lead to a decrease of touristic industry incomes. Long term whale watching benefits in Madagascar will remain strong if no major perturbation affects their natural habitat.

CASE STUDY 3: Evaluation of the Local Income from Ecotourism in Three National Parks: Andasibe, Masoala, and Andohahela. (Doster A. and Krasavin Al., WCS Volunteer Consultants, August 2006)

Andasibe is the second most visited park of Madagascar and the smallest one as well. Tourism incomes ensure 90% of its operational costs. Park appeal includes indris and the capital's proximity. Typical visitors include nationals, local residents, and foreign tourists. In terms of ecotourism infrastructures, five main hotels and a camping site managed by MNP and local associations can be found in its surroundings. Most foreign tourists stay for a night and 20% of them come through tour operators.

Masoala is the largest (in hectares) national park and its access is difficult because of lack of infrastructures. Park appeal includes the rainforest's diversity and dolphins. Typical visitors include people who have been visited the Zoo of Zurich, kayakers and naturalists, mainly from Switzerland (24%) or USA (18%). 90% of them go to Maroantsetra, 100% visit Nosy Mangabe, 50% go to Masoala, and less than 10% cross the peninsula. Ecotouristic infrastructures include seven hotels in Maroantsetra and three lodges on the peninsula. On average, visitors stay four to five days in the area and 40% of them from tour operators.

Andohahela is the only comprehensive park including both tropical rainforests (south of the Tropic of Capricorn) and dry forests. Its access is also difficult. Park appeal includes the tropical rainforest, the transition forest, and the semi-arid forest. Visitors are essentially French (41%), Malagasy (30%), Italians (24%), Americans (12%), and English (9%). Taolagnaro, the largest town in the park's vicinity has 50,000 inhabitants, 16 hotels, and 18 restaurants. In 2005, Taolagnaro had 13,500 tourists.

The following table shows the comparative leverage effect of the parks' visit on local incomes:

Table 22: Comparing Local Incomes in the Three Parks of Andasibe, Masoala, and Andohahela

	Andasibe	Masoala	Andohahela
Number of visitors	17,847	2,848	1,352
MNP incomes (US$)	192,500	17,500	5,800
Total local incomes (US$)	850,000	600,000	317,500
Local incomes/visitor (US$)	50	262	235
Local incomes/ MNP income	4	33	20

USD1 = MGA2, 000

This study highlights that ecotourism is a factor of development and source of income in the areas where the national parks have been set up. Considering the ratio between local incomes and MNP incomes, parks are levers of local development.

CHAPTER II

CURRENT STATUS OF NATIONAL BIODIVERSITY STRATEGIES AND ACTION PLANS

Part 1: National Strategies and Action Plans

Madagascar is one of the biodiversity hotspots at the global level. To better manage its natural resources, some national plans and strategies have been implemented and international conventions have been adopted and ratified for the benefits of biodiversity and human well-being. These plans and strategies are addressed in the following sections:

I. NATIONAL STRATEGY FOR BIODIVERSITY SUSTAINABLE MANAGEMENT

The National Strategy for Sustainable Management of Biodiversity (NSSMB) was established in 1996. It was developed and implemented as part of the national commitments made by Madagascar upon signing the Convention in 1993.

A. PRINCIPLES

Principles of the NSSMB are: to contribute to improvement of the living conditions of the entire population by reducing poverty based on knowledge (modern and traditional), ownership, and a sense of common welfare; to be part of the development process (at the local, regional, and national levels); to take the development of international trade into account; and to promote realistic alternatives.

B. STRATEGIC FOCUSES

The NSSMB is structured around three strategic orientation focuses: biodiversity conservation, valorizing biodiversity, and reduction of pressures.

B.1. BIODIVERSITY CONSERVATION

Biodiversity conservation has three main components:

- Ecosystem conservation: sustainable management of forest ecosystems, wetlands, marine and coastal ecosystems;
- Conservation of wild genetic resources: plant genetic resources and wild fauna;
- Conservation of the genetic resources of agro-biodiversity concerning species and varieties of fauna, flora, and local seeds.

B.2. VALORIZING BIODIVERSITY

Biodiversity valorization has three components:

- Improving knowledge on the economic, ecological, social and cultural values of biodiversity: traditional know-how and social and cultural practices; ecological value of biodiversity; economical value and trade; research and bioprospection.
- Revitalization of biodiversity product sectors: market analysis, value chain analysis, private sector involvement and promotion of sustainable sector management systems.
- Development of ecotourism: providing incentives and security to operators and assessing the environmental impacts of their investments.

B.3. REDUCTION OF PRESSURES ON BIODIVERSITY

Reduction of pressures on biodiversity is composed by following main actions:

- Improvement of the population's behavior towards biodiversity and development of incentives;
- Law and regulations enforcement and responsabilization of population. Development of alternatives to natural resources degradation: promoting integrated activities to reduce clearing and bush fires, and mitigate illegal logging and poaching;
- Mitigation of biotechnological risks and development of biosafety and improvement of knowledge on Genetically Modified Organisms (GMO).

II – THE ENVIRONMENTAL CHARTER AND THE NATIONAL ENVIRONMENTAL ACTION PLAN

A. THE ENVIRONMENTAL CHARTER

The Environmental Charter draws Malagasy environmental policy. Its finality is the reconciliation of man and environment. Additionally, the Charter is the law supporting the environmental program in Madagascar. It was adopted in 1990 and has been regularly updated every five year.

B. THE NATIONAL ENVIRONMENTAL ACTION PLAN (NEAP)

The NEAP was established as the Environmental Charter implementation tool. It is spread into three phases of five years with matching quantified objectives and is implemented with donors support. Madagascar is currently implementing the third phase (EPIII) or The Environmental Program.

Various partners contribute to the program such: multilateral institutions (GEF, the World Bank, UNDP, UNEP), bilateral cooperation organizations (USA, Germany, France, Switzerland), and international non-governmental organizations (CI, KBG, MBG, WCS, WWF, etc.). Completion of EP III is planned for 2009. The population's struggle for survival in the intervention zones has always been the main cause of pressure on natural resources. Current development programs address the needs for productive investments, social infrastructures, and access facilitation actions. Environmental non destructive alternatives need to be urgently developed and disseminated in these zones. The adoption of "win-win" principle requires the consideration of externalities and environmental benefits that are not always taken into account in conventional development approaches. In this context, the EP III is intended to contribute to the following purpose:

B.1. PURPOSE AND OBJECTIVES

The purpose of the EP III is to preserve and valorize the importance and the quality of natural resources for sustainable economic growth and a better quality of life. Its strategic objectives are:

- Adoption of renewable sustainable management and biodiversity conservation schemes by the population, and
- Ensured biodiversity conservation and susitainable natural resources management at the national level.

B.2. SPECIFIC OBJECTIVES

The specific objectives of the EP III are:

- Implement sustainable development activities;

- Manage sustainably forest ecosystems (natural and artificial), wetlands, and water reserves;
- Preserve and enhance the value of Madagascar's sensitive ecosystems within protected areas and conservation sites;
- Manage in a sustainable way the potentialities of marine and coastal ecosystems;
- Generate tangible positive behavioral change towards the environment;
- Establish the basis for sustainable funding and natural resources rational management are established; and
- Establish better environmental governance.

B.3. EXPECTED RESULTS

The results expected under each strategic objective are:

- Sustainable development actions implemented: i) sustainable alternatives promoted; ii) biodiversity sectors valorized in a sustainable way; iii) alternative energies promoted; iv) the management of the urban environment improved;

- Forest ecosystems (natural and artificial), wetlands, and water reserves managed in sustainable way: i) forests managed rationally; ii) the artificial forests cover expanded; iii) the management of wood fuel improved; iv) wild fires reduced; v) wetlands and water reserves benefit from sustainable conservation;

- Madagascar's sensitive ecosystems conserved and their value is enhanced in protected areas and conservation site: i) the ecosystems' representativeness promoted; ii) biodiversity and ecological processes maintained in protected areas and conservation sites; iii) ecotourism in protected areas and conservation sites developed and made profitable in cooperation with the private sector;

- Potentialities of the marine and coastal ecosystems managed in a sustainable way: i) sustainable development of coastal and marine zone activities promoted;
  ii) coastal and marine resources valorized and managed in sustainable and equitable way; iii) the biodiversity and the ecological function of marine and coastal ecosystems maintained; iv) prevention and mitigation of pollution and degradation of coastal and sea zones initiated;

- Tangible positive behavioral change towards the environment improved: i) decision-making support information and tools allow for sustainable management of the environment; ii) national capacities are built for effective and efficient management of the environment;

- The basis for sustainable funding and natural resources and environmental rational management actions established: i) specific instruments focused on sustainable financing developed; ii) local financing mechanisms set up;

- Better environmental governance established: i) commune development plans and inter-commune plans address the environmental dimension; ii) the country's development policies integrate the environmental dimension; iii) the institutional system improved; iv) the administration of environment reinforced; v) the forestry service reinforced.

III – MULTILATERAL ENVIRONMENTAL AGREEMENTS (Conventions, Protocols, Treaties)

Table 23: Environmental International Conventions Referring to Biodiversity Conservation, Ratified by Madagascar

Title of the conventions Date of effectiveness (DE)	Ratification	Implementation status (Strategy, Plan, etc.)	Links with biodiversity conservation	Success stories
RAMSAR Convention on Wetlands of International importance, more particularly water bird habitats **Ramsar (Iran)-Feb 02, 1971** **DE.21/12/75**	Act N° 98-003 of 02/19/98 Decree N° 98-261 of 09/23/98	- Six Ramsar sites of a total surface area of 787,555ha - Revitalization of CONARAMS with new national officers - Drawing up of the National Report to be submitted to COP 10 - Revision and updating of the National Wetland Management Strategy, national validation not completed - Development of texts on wetlands, promulgation to be done	Conservation of endemic and threatened biodiversity of the wetlands classified as Ramsar Sites	Three sites were granted the Ramsar status between 2005 and 2009 (Marsh of Torotorofotsy, 9,993ha, on 02/02/05, the Tsarasaotra Park, 5ha, on 05/09/05, and Lake Bedo, 1,962ha, on 05/12/07) and the award of the status to a 7th site – the Nosivolo river, 357,000ha – is underway.
Convention Concerning the Protection of World Cultural and Natural Heritages **Paris-Nov 16, 1972** **DE.12/17/75**	Ordinance N° 82-030 11/06/82	- Finalization of the development of the Integrated Management Plan of the Rainforests of Atsinanana with a policy committee set up. - Submission of indicative lists for a new proposal for the inscription of the "Dry forests of Andrefana" represented by 3 national parks, 2 Special Reserves, and 2 New Protected Areas as well as an extension of the Rainforests of Atsinanana.	Reinforcement of the management of specific ecosystems as well as maintaining the universal and exceptional value of Madagascar's biodiversity	Following IUCN's evaluation, reference ID N°1257, the property named "Rainforests of Atsinanana" represented by the six national parks of Marojejy, Masoala, Zahamena, Ranomafana, Andringitra, and Andohahela, of a surface area of 479,661ha is nominated World Heritage based on criteria IX and X, on June 27, 2007, during the 31st session of the World Heritage Committee in New Zealand.
Convention on the International Trade of Endangered Species of wild fauna and flora (CITES) **Washington-March 03, 1973** **DE.01/07/73**	Ordinance N°75-014 of 16/08/75 Act N°83-008 of 05/02/83 Decree N°95-012 of 07/06/95	Development of a conservation plan for some endangered species (underway) The CITES action plan has been implemented since 2005 and an evaluation report was completed by consultants	Protection of certain endangered species by a system of import permit.	Endangered species conservation plan (ex. Sahonagasy Action Plan, *Mantella cowani* Action Plan) - Key sites of two species of CR amphibians are

Amendment of article XXI **adopted in Gaborone**	in 2006. Completion at 80%	protected: Mangabe (25,238ha) and Fohosokina (300ha)

Source: MEF, 2009

Title of the conventions Date of enforcement (DE)	Ratification	Implementation status (Strategy, Plan, etc.)	Links with biodiversity conservation	Success stories
Convention on the Conservation of Migratory Species of Wild Animals (CMS) **Bonn- June 23, 1979** **DE. 11/01/83**	Act N° 2006-002 of 07/27/06	-Action plan (SSAP) jointly initiated by CMS and AEWA for each of the following bird species: *Ardeola idae* and *Phoeniconaias minor*	**CMS** Protection of migratory species whose conservation status is poor and their habitat **AEWA** Conservation of migratory birds and their habitat	Hosting the AEWA's Meeting of Parties (MOP) in Antananarivo, Madagascar from September 15 to 19, 2008 ; - Hosting of AEWA's 4th Conference of Parties on September 2008 in Antananarivo, Madagascar - Actions plans of *Ardeola idae* and *Pheonicopterus minor* operational - Monitoring of water birds in: the Region of Antsalova by the Peregrine Fund project 1995-2009; the Bay of Baly by PBZT 2002-2009, Lake Ihotry in the Region of Morombe 2005-2009 - Conservation of the water birds' habitats through the creation of terrestrial and marine Protected Areas and RAMSAR sites.
Agreement on African-Eurasian Migratory Waterbirds (AEWA)	Act N° 2006-003 of 07/27/06 Act 2006/006 of 07/24/06 Decree 2006/542 of 07/24/06			
Nairobi Convention for the Protection, Management, and Development of the Marine and Coastal Environment of the Eastern African Region **Nairobi-June 21, 1985** **DE.30/05/96**	Act N°98-004 of 19/02/98 Decree N°98-260 of 24/03/98		Preservation and rational management of the marine resources of the countries of Eastern Africa	
Protocol related to the protected zones as well as the wild fauna and flora in Eastern Africa				
Vienna Convention for the protection of the Ozone Layer. Vienna – March 22, 1985 DE.09/22/88	Act N°94-022 of 17/11/94 Decree N°95-032 of 11/01/95	Cooler Management Plan CFC management and elimination plan	International protection of the ozone layer for the protection of human health and the environment against the	
Montreal Protocol on Substances that Deplete the Ozone Layer. Montreal- Sept 16, 1987.DE. 01/01/89 **Amendments in London - 06/19/1990, Montreal- 09/17/97**	Decree N°96-321 of			

Copenhagen- 11/25/92 and Beijing- 12/03/99	02/05/96	harmful effects of its depletion

Source: MEF, 2009

Title of the conventions Date of enforcement (DE)	Ratification	Implementation status (Strategy, Plan, etc.)	Links with biodiversity conservation	Success stories
United Nations' Framework Convention on Climate Change (UNFCCC) **Rio- May 09, 1992** **DE.03/21/94**	Act N°98-020 of 12/02/98 Decree N°98- 168 of 12/18/98	- Updating of PANA - Technical recommendations resulting from the workshop on the evaluation of the impacts of Climate Change on biodiversity and human well-being.	- Biological biodiversity conservation through preservation of the climate system for the future and present generations - Stabilization of the concentrations of greenhouse effect gases (CO2) in the atmosphere at a level which prevents any anthropogenic disturbance of the climate system.	- Forest of Makira - Project TAMS (Tetik'Asa Mampody Savoka or Project to restore "savoka") in the Corridor of Ankeniheny-Zahamena
Protocol of Kyoto on Climatic Changes **Kyoto- December 1997**	Act N° 2003-009 of 09/03/03	- Inter-ministerial Task Force set up - Development of the REDD Strategy 2009-2012 underway, based on the project Approach already implemented - the 2nd National Communication, being finalized		
Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification **Paris- May 17, 1994** DE.26/12/96	Act N°96-023 of 09/04/96 Decree N°97-772 of 05/10/97	National Action Plan to Combat Desertification (to be aligned with the Decennial Strategic Framework Plan 2008-2018)	Protection of the biological diversity of arid, semi-arid, and dry sub-humid zones and preservation of their habitats	
Stockholm Convention on Persistent Organic Pollutants (POP) **Stockholm-May21, 2001**	Decree N° 2005-512 of 08/03/05	Development of the National Plan for the Implementation of the Stockholm Convention on Persistent Organic Pollutants (underway)	Protection of human health and the environment (biological diversity) against persistent organic pollutants	
International Treaty on Plant Genetic Resources for Food and Agriculture	Act N°: 42/2005 of 20/02/2006 Decree N° 156/21006 of 02/21/06	Bill on Plant Genetic Resources for Food and Agriculture	Conservation and sustainable use of plan genetic resources for food and agriculture and the advantages equitable sharing derived from their use in harmony with the Convention on biological diversity, for sustainable agriculture and food security.	The finalization of the bill on PGRFAA and making available the Standard Material Transfer Agreement (SMTA) are underway as part of the implementation of the Multilateral System for Access and Benefit-Sharing.

Source: MEF, 2009

IV- OTHER NATIONAL POLICIES

A. THE ENVIRONMENTAL CODE

The Environmental code will take over the Charter in more comprehensive form, including all new sectors and areas linked to the Environment. It has a validity of 20 years and the drafting of the bill is underway.

The changes in the national environmental protection policy as well as the increase of international standards and principles make it necessary to update the Environmental Charter, which can be considered as the framework law describing the management mode and protection of the Environment in Madagascar.

The environmental principles defined in Stockholm in 1972, the Rio Declaration in 1992, the Millennium Development Goal recommending a sustainable Environment, Agenda 21, all multilateral Environmental Agreements to which Madagascar is a party, the Malagasy constitutional principles of devolution, decentralization, customary usages, and the principles of administrative, criminal, civil, and business law must be integrated into this new code. Under this perspective, an effort was initiated to ensure consistency across the following 18 sectors, a preliminary step to the development of the code: Agriculture, Fishing/Aquaculture, Livestock, Land, Water and Forestry, Energy and Mining, Environment, Environmental Assessments, Tourism, Transports, Public Works, National Education and Higher Education, Scientific Research, Industry, Trade and Standardization, National Defense and Home Affairs, Culture and Telecommunications, Health, and Population.

B. CODE OF PROTECTED AREAS

The amendment or consolidation of the Code of Protected Areas (COPA) proves necessary, in the light of the principles developed by the International Union for the Conservation of Nature (IUCN) which added new categories (cat. III, V, and VI). The design of the new law is based on a few core principles:

- Giving due consideration to good governance, emphasizing modern management of protected areas;
- Protected areas support the promotion of sustainable use of natural resources for poverty reduction and development;
- In addition, involving the local population and all stakeholders: it is crucial to involve local authorities and communities, all sectors concerned from the various phases of protected areas creation process to natural resources management and conservation implementation.

The COPA was subject to a technical revision conducted by all stakeholders. It has already being approved for adoption by the two chambers of the Parliament, and is awaiting promulgation, as the last step. Enforcement texts are currently being drafted.

The PlanGRAP was developed by the Madagascar National Parks (MNP), whose mission is to conserve and manage a nationwide network of Parks and Reserves, representative of the natural heritage that is distinctive to Madagascar. Relevant objectives and achievements are presented in Annex V of the present document.

V. ENDANGERED SPECIES CONSERVATION PLANS

Strategies and action plans for the conservation of endangered species from a few taxonomic groups have been developed and implemented: the strategic plan for the management of forest plant genetic resources, the amphibians' action plan, and strategies for the conservation of lemurs, tortoises, crocodiles, Vositse, chameleons, and water birds, etc.

A. STRATEGIC PLAN FOR THE MANAGEMENT OF FOREST PLANT GENETIC RESOURCES

The management strategies plan includes:

- investigation on genetic variability of some target species;
- Species biological study;
- ethnobotanical, social and economic studies of the species;
- species conservation (in situ and ex situ) ;
- breeding and domestication of the species;
- valorization, and
- legal and institutional organization.
    - Species prioritized in the strategic plan for forest plant genetic resources management are listed in the table below (MWF/NSFS, ONE, FOFIFA – 1999).

Table 24: Priority forest species and their uses

Species	Family	Area of origin	Uses
Evodia belahe Baill.	Rutaceae	Northeastern and Southeastern Coasts	Ferment for traditional alcoholic beverage
Dalbergia baroni Baker	Fabaceae	Eastern region, from Sambava to Farafangana, low to mid altitudes	The wood is used for sawlog, marquetry, and making of floors
Dalbergia greveana Baill.	Fabaceae	Western region, from Antsiranana to Toliara	The wood is used for sawlog, structural timber, and carving; the bark is used for medicinal purposes
Dalbergia monticola Bosser & Rabevohitra	Fabaceae	Western region of average altitude	The wood is used for sawlog and joinery
Diospyros perrieri Jumelle	Ebenaceae	Boina and Androy Regions	Ebony is used for carving and joinery
Khaya madagascariensis Jumelle & Perrier	Meliaceae	Sambirano Region	Redwood is used for joinery and crafts, gum resin
Ocotea cymosa Palacky	Lauraceae	Eastern coast	Hardwood is used for timber and joinery
Phyllarthron madagascariense K. Schum	Bignoniaceae	Central Highlands	The wood is used for crafts-making and the leaves for medicinal purposes
Prunus africana Hook f. Kalkmann	Rosaceae	Highlands, Middle-East, East	Medicinal purposes

Source: NSFS, 2009

B. CONSERVATION PLANS AND STRATEGIES FOR SOME TAXONOMIC GROUPS OF WILD FAUNA

B.1. THE SAHONAGASY ACTION PLAN FOR AMPHIBIANS

The "Sahonagasy Action Plan" (Andreone and Randriamahazo, 2008) gives specific recommendations on how to ensure the survival of Madagascar's amphibian fauna over a five-year period (2008-2012). The development of this plan took into account the CBD objective for 2010 and the seven fields of activities mentioned in the VII/30 decision that were adopted by the Parties at the 2004 Conference. Its strategic focuses and priority activities are: coordinate research and conservation activities; monitor Madagascar's amphibians; manage emerging diseases; increase the surface of protected areas by creating areas of climate refuge for amphibians; manage amphibian conservation priority sites; develop sustainable collection models for CITES species; conduct captive breeding and zoological park activities and develop a unified herpetological collection.

B.2. REPTILES

B.2.1. Chameleon Species Conservation Strategy

Brady and Griffiths (1999) proposed a draft management plan for Malagasy chameleons in their report to the IUCN Species Survival Commission. They proposed a plan based on the national legislation which prohibits the collection of chameleons in protected areas (Categories 1-3 of IUCN) but allows collection in other sites, according to local quotas.

Priority actions include the conservation assessment of all chameleon species by using IUCN criteria standards; reviewing geographical species distribution in comparison to the land use and diversity; establishment of the Chameleon Species Conservation Strategy for Madagascar; implementation of conservation action at the key sites' level or for priority species; conducting taxonomic and genetic evaluations in collaboration with specialists; conducting a study of the altitudinal gradients of the species that could be affected by climate change and help CITES Authorities in Madagascar meet the conditions of the Convention (as they apply to chameleons).

B.2.2. Tortoise Conservation Action Plan

The tortoise action plan concerns the *Astrochelys yniphora* species. The general objective of this plan is to increase the viability of wild and captive populations of Madagascar tortoise *A. yniphora*. Priority actions include bringing poaching and illegal trade of the species to a halt and improving captive breeding and reintroduction.

B.2.3. National Crocodile Management Action Plan

The crocodile management strategy is part of the Global policy of nature management and conservation in Madagascar. Historically, this work plan, known as the "National Action Plan for Crocodile Management in Madagascar" was drawn up according to CITES's recommendation (supported by consultants and experts from CITES and the Crocodile Specialist Group [CSG]) in late 2007. This plan was later on validated by the Government of Madagascar as a tool for implementing the strategy to improve the conservation, management, and sustainable use of *Crocodylus niloticus* in Madagascar.

This National Action Plan for Crocodile Management includes:

Ensuring rational management of *C. niloticus:* visiting egg collection sites; improving the centers' monitoring by updating the manual for control; involving informal craftsmen and craftsmen's associations in the plan's implementation; analyzing and evaluating previous inventory studies; organizing an aerial and/or nocturnal inventory study of crocodiles; developing a wild populations monitoring program.

Monitoring ranching operations: performing periodic inspection of breeding and development centers and implementing a monitoring system (monitoring breeding centers, labeling leathers in the presence of the Management Body in charge of verifying the breeding centers' productions, so as to set future quotas); setting an annual export quota for leathers of different origins. Other items related to the CITES Permanent Committee and the 15th Conference of the Parties to CITES: reporting to the CITES Permanent Committee; proposing the addition of the crocodile population of Madagascar to CITES' Annex II.

B.3. BIRDS

As for birds, integrated plans and plans pertaining to target species are to be reported on.

a) Integrated Plan

Species selected among conservation targets in ecosystems such as the New Protected Areas (NPA) of Madagascar and Ramsar sites are: *Haliaeitus vociferoides* (Peregrine Fund, in the Wetland Complex of Manambolomaty), *Eutriorchis astur* (Peregrine Fund, Masoala), *Amaurornis oliveri* (Asity Madagascar, NPA Mahavavy Kinkony), *Anas melleri* (Durrell, NPA Alaotra), *Anas bernieri* (Durrell), and *Aythya innotata* (Peregrine Fund & Durrell).

b) Action Plans for Target Species

As part of AEWA (cf. international conventions), specific action plans were developed for two migratory species of Madagascar, *Ardeola idae* and *Pheonicopterus minor*.
The *Ardeola idae* action plan (Madagascar pond heron) focuses on determining the current population's size and its trend, performing a gap analysis, conducting field activities, improving the species' profile in its distribution areas, collecting further information on its biology, ecology, and the problem of hybridization, and conducting monitoring actions at the target sites' level.
A similar action plan has been developed for *Pheonicopterus minor* (Lesser flamingo).

B.4. MAMMALS

B.4.1. Primates Conservation Strategy

A Primates conservation strategy has been developed and implemented at the national level. Its objectives are to define the geographical distribution, especially for new species and "data deficient" ones; to achieve the classification of primates' habitats as protected areas; to facilitate ecological monitoring; to provide incentives for ecological services through the payment system; to open up new prospects for studies and researches on primates; and to develop specific conservation projects.

Projected activities include: primates inventories; genetic studies; lemur ecological and behavioral studies; ecotourism development; instituting a doctoral curriculum at the University of Mahajanga; and setting up captive breeding and conservation of genes banks (through collaboration with international organizations and the NGO "Madagascar Fauna Group").

B.4.2. Conservation Action Plan for Hypogemus antimena (Vositse)

The objective is to develop and implement plans to protect the Vositse's remaining habitats, while protecting Menabe's biodiversity as a whole. Projected activities include: stopping exploitation, clearing, and hunting in the area; promoting the establishment of local and communal rules (*dina*) to protect this species; developing and implementing an Information Education and Communication (IEC) plan (at regional, local, and national levels) in favor of Vositse; supporting studies on the species to collect further information; integrating the protection of Vositse habitats into a development plan; ensuring a captive safety net (including a zoological park) to preserve the species; conducting awareness-raising; enforcing and amending forest-related legislation; implementing a regional forest master plan; providing reinforcement and support to the Water and Forests services for prospecting, visits, controls, or monitoring votsitse habitats.

Picture 8 : Hypogemus Antimena (Vositse), by DWCT Madagascar

Part II: Progress toward the National Strategies for Biodiversity Sustainable Management

I. BIODIVERSITY CONSERVATION

A. ECOSYSTEM PROTECTION

A.1. PROTECTED AREAS

The main achievement and conclusive results get from the ecosystem conservation efforts is the increase of the surface of existing protected areas (PAs). While Protected Areas cover is about 3% of the national territory in the past. Currently, their surface cover is about 8% of the territory (final and temporary protection status). Madagascar made official its commitment in Durban, at the World Park Congress to triple the surface of its protected areas. All of the ecosystems existing in Madagascar (terrestrial, wetland, marine, and coastal) are significantly represented in this protected areas system (cf. Map 1, Appendix II) and the Act on the adoption of IUCN's other categories has been adopted by the Parliament. As Protected areas and Koloala sites (sites for sustainable management of forest resources use) are being actively set up, the map may be subject to a few changes.

Defining new protected areas process is based on rigorous science (results from biological inventories, prioritization of threatened species distribution, and remote sensing of satellite data) and agreement from local people and local, regional, and national authorities. Safeguard measures have become a common part of the creation process, with social and environmental impact assessment studies. All scientific information on Protected Areas characteristics is available at http://atlas.rebioma.net

Picture 9: Allee de Baobab, by Mittermeier

The table below shows trends over the years of different ecosystems within protected areas.

Table 25: Changes in the Surface Area of Ecosystems Located Inside Protected Area, per Year of Creation (In Ha)

Type of ecosystem	Prior to 2003	in 2005	in 2006	in 2007	in 2008	Extension Existing PA	NPA (Application being processed)	NPA (Application to be created)
Stretches of water	3,057	3,309	46,433	47,944	57,777	58,080	60,858	64,816
Mangroves	6,097	9,683	46,303	48,020	59,322	59,327	63,809	76,201
Farmland	37,503	62,611	126,645	127,409	150,116	157,734	161,175	190,472
Western dry forest	261,174	280,198	474,073	481,202	489,417	503,319	533,999	582,754
Mosaic herbland	222,423	242,313	332,624	348,852	374,257	376,053	426,049	599,384
Wooded herbland	222,664	277,517	497,954	522,821	556,417	604,193	629,985	739,845
Western rainforest	20	20	20	20	20	20	3,793	3,793
Western dry forest	108,927	108,927	130,225	130,225	151,521	151,521	154,040	154,040
Southwestern dry thorny forest-thicket	122,208	122,208	147,236	147,236	167,663	167,672	167,676	177,154
Southwestern degraded dry thorny forest	130,795	130,795	230,996	412,969	525,795	527,724	552,293	777,263
Lakes / Pond	5,699	7,192	48,576	52,053	72,215	72,225	76,307	105,817
Rainforest	813,351	1,576,999	1,839,619	1,839,640	1,891,351	2,143,158	2,170,797	2,399,937
Littoral forest	226	2,721	3,757	3,757	3,757	3,757	5,869	6,505
Degraded rainforest	62,922	119,251	160,282	160,282	167,492	208,206	222,314	249,794
Southwestern coastal bushy cover	3,266	3,266	3,427	3,427	3,427	3,454	3,454	45,468
Western sub-humid forest	27,541	27,541	27,541	27,541	37,032	37,032	37,162	37,162
Tapia forest	27,130	27,130	27,130	27,130	27,130	27,130	27,224	27,224

Sources : Atlas of Madagascar's Vegetation, RBG Kew, 2007 and Digital Atlas of the Protected Areas system, SAPM/REBIOMA, 2009

To ensure sustainable financing of conservation actions, two environmental foundations have been created. The Foundation for Biodiversity which is funded by different donors (World Bank, KfW, AFD, Conservation International, WWF, Government of Madagascar) and whose role is to support Protected Areas management activities; and the Tany Meva Foundation (US Government and Government of Madagascar), which is in charge of community-based activities supporting conservation. The assets mobilized for the Foundation for Biodiversity now reaches up to USD52 millions. However, it is necessary to revise needs in assets, because it does not cover the current protected areas system, but only for the existing protected areas network before the commitment made in Durban.

A.2. NATURAL RESOURCES MANAGEMENT TRANSFER

Natural resources management transfer will be conducted for forest blocks located out of protected areas and wetland ecosystems. It is based on a national and regional forest zoning. Regarding wetland ecosystems, six Ramsar sites (787,000ha) are currently managed under a participatory approach. A total of 500 natural resources management cases have been transferred to local communities and cover about 178,000ha of forests, 54,800ha of mangroves, and 54,850ha of fishing areas.

A.3. ENVIRONMENTAL IMPACT ASSESSMENT

To prevent investments from having harmful effects on the ecosystems resulting in negative, cumulative, and irreversible changes, the Government drew up a list of sensitive zones and developed an appropriate system to record environmental compliance for investments. The system's effectiveness is crucial for large-scale investments (mines and roads) environmental issues.
Ten years after the promulgation of the MECIE decree (decree on Making Investments Compatible with the Environment), there is among investors a good level of willingness to abide by legal requirements, as indicated by the annual increase in the number of applications for environmental permit submitted at the National Office of Environment (cf. Chapter 3).

B. BIODIVERSITY CONSERVATION

B.1. CONSERVATION OF FOREST RESOURCES

B.1.1. In-Situ Conservation

Better management of the protected areas allow for conserving and regenerating natural resources.
In-situ conservation actions are conducted in some forests, as part of research-development. For instance, they include natural forest enrichment trials (i) in Tampolo (on the eastern coast) by the Forestry Department of the Agronomy High School (ESSA-Forêt); (ii) in Ambavatapia (sclerophyllous forest of Tapia in the Southern Highlands) by the Environmental Management Supporting Service (SAGE), (iii) in Mahatsara by the Department of Forest and Fish-Farming Research (DFPR) of FOFIFA. Sylvicultural trials were also conducted by DFPR on fifty-eight (58) native species, in Ranomafana.
Finally, organizations that are not directly involved in the forest resources management also perform in-situ regeneration. For example, Marovoay farmers conduct raffia (*Raphia farinifera* regeneration) in raffia valleys by transplanting wild seedling through direct seeding or using young seedlings from village nurseries.

B.1.2. Ex-Situ Conservation

Numerous entities are involved in ex-situ forestry resources multiplication in Madagascar. In terms of forest seeds conservation actions, the leader is the National Silo of Forest Seeds (SNGF), created in 1986. It provides excellent quality (physiologically and genetically) in sufficient quantities of forest seeds while ensuring strict measures of conservation. Since 2000, SNGF has been collaborating with the Royal Botanic Garden (UK) as part of the Millennium Seed Bank (MSB) project. This project conducts researches on the long-term seeds conservation. As part of the project, seeds of forest species from arid and semi-arid region are collected. About 2,000 collections of plant species are at the seeds bank under the Millennium Seed Bank project. They mainly include species that are endangered, overused, and for social and economic use.

TheTsimbazaza Botanical and Zoological Park, created during the colonial period, was established to keep collections of living flora and fauna species. Its surface area is about 1ha and some species from the Eastern, Western, and Southern, arid regions, such as *Pachypodium spp*, *Alluaudia spp*, *Didierea spp*, *Adansonia spp*, and *Euphorbia spp* can be found there, as well as a palm grove, an orchid's greenhouse. Some species prioritized by the National Strategic Plan are also present there: *Ocotea cymosa*, *Phyllarthron madagascariense*, and *Dalbergia sp*.

Early in the last decade, arboretums were also created in some Forest Stations throughout the island. Fast-growing exotic species were planted at these arboretums to better understand their reforestation potentiality. As for conservation trials, their setting up is part of improvement programs and used to preserve the genetic inheritance of a given species as a whole. Exotic species for reforestation such as *Pinus*, *Eucalyptus*, cashew trees, and *Khaya madagascariensis* have been planted in different regions of the island by the DFPR-FOFIFA, in collaboration with national or international partners.

Implementation Cases of the Strategic Plans for Sustainable Management of Forest Plant Genetic Resources at the SNGF (in collaboration with other partners)

Case 1: Prunus Africana (Rosaceae)

Study topic in 2005: Implementation of the specific national action plan for sustainable management of a given species' genetic resources:

- Drafting a legal text on the species exploitation (from collecting to exporting semi-finished products);
- Training farmers who collect barks;
- Disseminating the seed multiplication technique;
- Carrying out studies on *Prunus africana* as a sector;
- Conducting an inventory of the species' natural range in pilot sites.

Case 2: Khaya madagascariensis (Meliceae)

Study topic in 2006: Assessment of an ex situ protective plantation of the species from six different geographical origins in Tsaramandroso (a dry ecology), Boeny region, (Natural area in Sambirano with a wetland ecology)

Objective: Study of the species' adaptability outside of its natural habitats.

Methodology:

- Assessing growth parameters: height and diameter;
- Making comparisons across geographical origins: five sites from the natural area and one outside.

Results:

- The species has a high development potential and therefore a high ex-situ conservation potential ;
- Behaviors are different across genotypes (geographical origins);
- There is a positive correlation among growth characteristics;
- The species is resistant to physical threats such as wild fire and wandering cattle;
- The spouts develop after cuts.

Case 3: Dalbergia monticola (Fabaceae)

Study topic: Genetic diversity, reproductive physiology and impact assessment of fragmentation on *Dalbergia monticola* in the eastern forest of Madagascar (doctorate degree research conducted from 2005 to 2008)

Study approach: Sampling of sub-population in its distribution areas, collection of plant material (leaves and seeds), analysis of genetic diversity with molecular markers, trial multiplication, and assessment of juvenile growth.

Results: the impacts of anthropogenic activities on the species genetic diversity was observed; genetic variability in the species according to latitudinal gradient throughout its distribution areas was

noticed; different seeds' morphology from different localities was identified due to different ecological factors as well as the forest's cover status; habitat condition have effects on seeds germination and there are correlations among the juvenile growth parameters.

Recommendations: Given that *Dalbergia monticola* still has a high level of diversity in its natural habitat, local management actions should be implemented for rational management of the remaining genetic heritage. This include, for instance, preserving in situ the population variability within four main regions (North, Center North, Center, and South) while maintaining a sufficient number of reproductive trees in the forest exploitation plots. Combining ex-situ and in-situ conservation approach can be considered for seeds conservation development (genes banks), and for creating protective plots given that the high germination rates of seeds and the seedlings easy adaptation at the juvenile stage. Furthermore, *Dalbergia monticola* is suitable for multiplication by cuttings as demonstrated by previous research.

B.2. Conservation of wild plants related (WPR) to cultivated plants

B.2.1. In Situ Conservation of WPRs

In Madagascar, action plan or program for in situ conservation of WPRs is not established yet. Those that grow inside protected areas such as wild coffee trees, yams, and Canellaceae already benefit from the conservation actions implemented in those forest areas.

B.2.2. Ex Situ Conservation of WPRs

Two wild rice species (*Oriza longistaminata* and *O. punctata*) were recently introduced into FOFIFA's genes bank. About forty years, *Mascarocoffea* spp. has been planted in a wood park and under a natural forest cover developed in the Kianjavato station. It should be noted that the duplication of the wild coffee tree collection in East Ilaka did not survive due to several cyclones that hit the area, these disasters is aggravated by the lack of maintenance due to funding issues. Finally, the Botany Department at the University of Antananarivo has a small collection of yam seeds.

B.3. PROTECTIVE MANAGEMENT OF CULTIVATED PLANTS

Since the 1960's, many expeditions to prospect and collect plant genetic materials have been organized by FAO with international agricultural research institutes collaboration such as IPIGRI (former IBPGR), IRD (former OSTOM) or IRRI, and national research centers, especially FOFIFA. Other prospection and collection missions were initiated by the institutes and centers themselves. The material collected is kept in cold rooms or coolers (rice, seed leguminous plants) or directly planted in fields (cassava, perennial plants).

B.3.1. Main National Collections

Two organizations hold more than 95% of the national collection of RPGAA: FOFIFA (the National Center for Applied Research to Rural Development) and FIFAMANOR (the Madagascar and Norway cooperation for livestock and agriculture development).

The collection includes (i) local ecotypes that were prospected in the past or recently; (ii) old specimens (more than 40 years ago); (iii) recent introductions; (iv) new varieties selected from varietal creations. It should be noted how important the accessions of local ecotypes is in the FOFIFA's collections (35% for rice, 13% for maize, 32% for vigna, and 60% for vouandzou). Similarly, this collection is enriched with WPRs, more than 1,000 accessions of *Mascarocoffea* belonging to about sixty species and two species of wild rice (*O. longistaminata* and *O. punctata*).

The maintenance of the collection requires ongoing financial support. A year without maintenance or the occurrence of natural disasters is enough to cause significant losses of accessions that are hard to restore thereafter. However, since the 1990's, government subsidies to the organizations ensuring the custody of the collections have been shrinking to almost nothing. The priority goes to more promising activities. In addition to the financial issue, the lack of technical staff has resulted in no longer maintaining some collections.

Over the last decade, promotion of regional cooperation to enhance agricultural research supported by international donors has been improved. Now, FOFIFA is a member of ASARECO and its various thematic networks. This initiative – which has been operational for two or three years, has fostered the revitalization of some sectors such as seed leguminous plants (ECABREN), cassava (EARRNET) or maize (ECAMAW), and therefore has resulted in enriching the collections through exchanges of plant materials. However, it's noticed that in 2005 the number of research decreased when compared to ten years ago.

A special note should be made about rice IRRI cooperation is being intensive due to the importance of this cereal in Madagascar. As an excellent result of this collaboration, the collection has been enriched.

Due to private partners' supports, the maintenance of the collection has been improved in sectors such as cotton plants and/or coffee-trees, HASYMADAGRIS for cotton, and UCC-Japan Corporation for coffee tree.

Table 26: Changes in the number of the main collections of cultivated plants

Species or group of species	Custodian organization	N° accessions as of 1996	N° accessions as of 2005	Observations
Grains				
Rice	FOFIFA	4127	6,210	Improved due to varietal creations
Wheat	FOFIFA	169		Abandoned
	FIFAMANOR	2570	352	7 disseminated
Triticale	FIFAMANOR	603	210	7 disseminated
Oat	FOFIFA	15	17	Used as fodder
Barley	FOFIFA	34		Abandoned
Maize	FOFIFA	371	325	Improved despite setback in the past
Tubers				
Cassava	FOFIFA	330	202	Improved despite setback in the past
	FIFAMANOR	67	na	
Potato	FIFAMANOR	181	194	11 disseminated
Sweet potato	FIFAMANOR	72	91	9 disseminated
Taro	FIFAMANOR		21	9 disseminated
Leguminous plants				
Groundnuts	FOFIFA	349	275	
Beans	FOFIFA	321	222	disseminated
Vigna	FOFIFA	135	98	
Voandzou	FOFIFA	28	47	
Soya	FOFIFA	272		Abandoned
Processing cash crops				
Cotton	FOFIFA	160	912	Increase due to active varietal creations
Sugarcane	FOFIFA	338		Abandoned
	SIRAMA	77	na	
Cash crops				
Coffee	FOFIFA	1,282	3,330	Maintenance, collection, and varietal creation activities resumed since 2001
Pepper	FOFIFA	195		Abandoned
Vanilla	FOFIFA	3,000	?	No update
Fruit trees				
Mango	FOFIFA	46	?	Management contract with a private operator
Banana	FOFIFA	12	?	Decimated by cyclones
Other fruits	FOFIFA	43		Abandoned
	SMV	na		Abandoned
	SMV	na		Abandoned
Kitchen garden plants				
	FIFAMANOR	207	46	19 disseminated
Forage	FOFIFA	20	97	New introductions of forage grass and leguminous plants

Source: FOFIFA, 2009

B.3.2. Private Collections

Private organizations and NGOs working in rural development have also their own small working collections, generally duplication from the two main organizations mentioned previously or introductions multiplied then directly disseminated among users such as:

TAFA, a NGO that conducts research on the vegetation cover system or "Système de Couverture Vegetale" (SCV) and collects forage plants and creeping leguminous plants. It also ensures seeds multiplication and their dissemination among famers;

FAMAMA, a private company working on the cashew tree;

La *Pépinière de la Mania*, a NGO providing support to farmers in the areas of fruit tree and coffee farming;

The Technical Horticultural Center of Toamasina (CTHT), an inter-trade association (grouping producers, operators of the para agricultural and food processing sectors, and operators working at the post-sector level), that produces and disseminates improved plant materials: litchi, mangosteen, granadilla, pepper plant, pink peppercorn, clove tree; and

The Technical Horticultural Center of Antananarivo (CTHA), a sister association of the one above, whose main interventions pertain to introducing and disseminating the "Favette" strawberry variety, the development of in-vitro multiplication of orchids and the definition of technical process and innovative crops (very fine size Green beans, honeydew melon, edible-podded peas, endives).

B.4. EXAMPLES OF ENDANGERED FAUNA SPECIES CONSERVATION

Case 1: Amphibians

The Sahonagasy Action Plan was officially launched in November 2008. Tangible results were achieved under this plan:

- Various communication and public awareness events performed such as the Celebration of World Frog Day in Taolagnaro (April 2006) and the Madagascar Tomato Frog Festival in Maroantsetra (June 2009);
- Conservation action plans of *Mantella cowani*, the most endangered amphibian in Madagascar, and *M. auriantiaca* implemented by different environmental actors such as ASG, CI, MATE, UADBA, and MAVOA;
- Distribution area of *M. cowani CR,* the most endangered amphibian in Madagascar, has increased (Rabibisoa et al. 2009, in submitted to Froglog);
- The creation process of two new protected areas, Mangabe (Moramanga) and Fohisokina (Antoetra), which are habitats to *M. aurantiaca* and *M. cowani,* is underway and the *M. cowani* distribution is being modeled by using Maxent program, based on the climate parameter (Rakotondrazafy et al., in prep.); and
- A conservation and observation site of *Discophus antogilii* established in the town of Maroantsetra (Tomato Frog Village).

Case 2. Reptilians

a) Chameleons

Research is being conducted on four traded species to assess their population sizes: *Calumma parsonii, Furcifer campani, Furcifer rhinoceratus,* and *Brookesia decaryi.* Four protected areas (Marojejy, Ambre Mountain, Andringitra, and Andohalela) have been subjected of monitoring and altitudinal distribution studies in relationship with the impacts of climate change to track changes.

b) Tortoises

The following points were achieved as part of the action plan implementation:

- Captive breeding and head-starting in Ampijoroa in the Ankarafantsika National Park improved: More than 200 plough tortoises captive-bred, including 45 that released in their natural habitat in Beaboaly. The captive and released populations' health is being monitored;
- The Baly Bay National Park created (which includes the species' habitat); and
- Research is underway on population dynamics: its density, distribution, use of habitat (using telemetry), genetic studies, and additional studies on the tortoises' habitat, geographical distribution, threats, captive breeding, and reintroduction protocol.

c) Crocodiles

Achievements of the implementation of the *Crocodilus niloticus madagascariensis* management plan are:

- The monitoring of centers improved with the updating of the control manual: the Direction of Control at DGEF provided capacity-building to field actors (2008);
- Craftsmen associations and informal craftsmen involved in the action plan implementation;
- The previous inventory studies done by the members representing CSG analyzed and assessed; and
- Aerial and nocturnal inventories of crocodiles was performed along rivers of Betsiboka, Ikopa, Kamoro, Mahavavy Sud, and Mahajilo (July-August 2008) and surrounding lakes such as Ravelobe Lake, and in three sections of River Mahavavy Sud (November 2008). Other inventories are planned in 2009 of Ankarana, Ankarafantsika and the Tsingy of Bemaraha Protected Areas, and the regions of Besalampy, Maintirano, and Antsalova.

As far as the ranching operation monitoring, the following points should be noted:

- An exploitation record and regular reporting rules for each center have been established: Three farms, REPTEL, Croco'Ranching, and Le Domaine de Saint Christophe, pursue these requirements;
- The leather labeling performed in presence of the Management Body staff; and
- The production of the breeding centers is checked in order to set future quotas. As for slaughtering wild individuals, the quota is currently set at 200 (quota W).

Case 3: Mammals

a) Lemurs

Lemurs' conservation is done both in situ and ex situ. The in situ conservation occurs within protected areas and their distribution has much influenced the identification of new protected areas in Madagascar.

The number of partners engaged in specific conservation projects, such as WWF working on *Propithecus candidus* and the Aspinall Foundation working on *Prolemur simus*, is ever increasing. A lemurs action plan is being negotiated as well as a specific conservation project like "Population and Habitat Viability Analysis" (PHVA) for *Prolemur simus*. Lemurs' conservation plan has been implemented in different areas: in Menabe by the Durrel Wildlife Conservation Trust, in Makira by the Primates Research and Study Group of Madagascar (GERP), and in the Ankeniheny-Zahamena corridor (CAZ) and the forest corridor of Fandriana Vondrozo (COFAV) by the Conservation International.

b) Hypogemus antimena

The Menabe Antimena site – a distribution area of *Hypogemus antimena* awarded of temporary protection status in March 2006. The process to secure legal protection status is underway. This new protected area falls under Category 5 and *H. antimena* was selected to be among its conservation targets.
In all, 215 burrows (121 out of them are active) spotted. A manual for species monitoring implemented. It can be asserted that *H. antimena* currently exist in the forest zone west to the road that links Morondava to Ampataka. Compared to the year 2005, it is noticed that the number of active burrows increased in 2007 (A total of 127 burrows in which 84 out of them are active). This increase is a good sign and means that Vositse population doesn't decline. This seems to be confirmed by the presence of newly burrows spotted in the North (Kiboy forest) as well as some individuals prowling around the CNFEREF camp in Kirindy.

Case 4: Birds

As part of the Convention on Biological Diversity implementation, the following results were achieved:

- The AEWA, 4th Conference of the Parties was hosted by Madagascar, in Antananarivo on September 15 to 19, 2008;
- *Ardeola idae* and *Pheonicopterus minor* action plans implemented;
- Some monitoring birds activities are underway: in the region of Antsalova by the Peregrine Fund project (1995-2009), in the Bay of Baly by PBZT (2002-2009) and in Ihotry Lake, Region of Morombe (2005-2009); and
- Waterbirds conservation has been enhanced by the setting up of terrestrial and marine protected areas as well as Ramsar sites.

Case 5: Fish

Threatened Fish Conservation achievements are described below:

- Species that are threatened to be extinct in Madagascar (*Paretroplus petiti* and *P. dambabe*) as well as abroad (family of *Aplocheilidae, Bedotiidae, Chiclidae, Eleotridae*) are being captive-bred;
- *Ratsirakia legendrei* (figoa) is being captive-bred as part of the Ambatovy project in collaboration with the Animal Biology Department of the University of Antananarivo;
- Conservation actions have been carried out in 10 wetlands: Mahavavy-Kinkony and Mangoky-Ihotry wetland complexes, Nosivolo and Anjingo Rivers, Alaotra and Bedo Lakes, complex of Manambolomaty and Bemanevika-Bealalana (lake, marsh, forest, and savanna), Tambohorano (Mandrozo), Ambondrombe. Seven out of them are temporary protected areas.
- A development plan has been drafted (and/or validated) for the following sites: Mahavavy-Kinkony, Nosivolo, Manambolomaty, and etc. Conservation targets in each site have been identified, in most cases. A management structure has been established in two sites, Mahavavy-Kinkony and Mangoky-Ihotry.

C. IMPLEMENTATION OF THE CONVENTION ON THE INTERNATIONAL TRADE OF WILD SPECIES (CITES)

Pursuing the previous wild species trade management problems in the country, a national action plan recommended by the CITES Secretariat has been developed by Madagascar. This five-year action plan was unanimously validated by national as well as international stakeholders in 2003. Implementation began in 2004. In 2008, satisfied with the achievements, the CITES Permanent Committee recommended relieving Madagascar from the obligation to submit a report at the Committee's following session.

Table 27: Results of the Implementation of the CITES Action Plan

Activities	Results
Legislation	
Drafting of the law on international trade of wild species	-Act N° 2005 – 018 of October 17, 2005 - Enforcement decree N° 2006 – 097 of January 31, 2006
Updating laws on fauna	Decree N° 2006 – 400 of June 13, 2006
Formalizing structures	- Scientific authorities - Permanent Secretariat - Operators' Association - CITES Scientific Committee
Scientific contribution	
Field study on highly traded species	Cf. Biodiversity knowledge improvement
Management system improvement	Manual of Procedures for wild fauna and flora management
Communication actions	
Capacity building for all stakeholders of wild species management	- Forest and environment agents, police officers, gendarmes, customs officers, economic operators, representatives of the Ministry of Justice, teachers, etc. in the six former provinces of the country grouped per neighboring regions
Production of communication tools	- Species identification sheets (41 fauna species and 48 flora species) -CD-ROM on CITES (legislation, procedures, roles of Scientific Authorities and Management Body) -Website on CITES Madagascar

Source: MEF, 2009

Several donors, such as WWF, Conservation International, the French Cooperation, and the USAID through the JARIALA project, contributed to the implementation of this action plan.
Trade cost-benefit analysis, which was funded by the German-Malagasy program, was postponed because of the current political situation.
The legislation related to flora is being developed.

II. VALORIZING BIODIVERSITY

A. IMPROVING BIODIVERSITY KNOWLEDGE

A.1. ENVIRONMENTAL DASHBOARD

The country has a national environmental dashboard or "Tableau de Bord Environnmental" (TBE) and regularly generates reports on the environmental status. Although initially designed to be a decision-making tool, the national environmental dashboard proved useful to the different research and training work at the country's level.
Subsequent to the administrative regions creation, environmental dashboards have now been fine-tuned down to regional level. Eighty percent (80%) of the regions now have their own dashboard. In addition, the functions of clearinghouse and knowledge management on biodiversity and biosafety are ensured by the National Office for Environment (ONE).

A.2. REGIONAL ENVIRONMENTAL POLICIES AND PRESCRIPTIONS

As part of the effort to integrate environmental concerns into decision making and based on existing knowledge, prescriptions related to the environment were designed to be applied for regions' development policies. More than half of the 22 regions of Madagascar now have such prescriptions.

A.3. IMPROVING BIODIVERSITY KNOWLEDGE AND ITS VALUE

Improving biodiversity knowledge and its value promote sustainable management of a given species. Results from species knowledge improvement could be used for CITES or for species conservation assessment in the IUCN red list.

A.3.1. Fauna sectors

Knowledge was improved through target species studies such as a) national or international scientific workshops for conservation species assessment (e.g.: Global Amphibians and Mammals Assessments in 2004 and in 2005) or b) developing species conservation strategies or plans (e.g.: the Conservation Strategy for Madagascar's Amphibians [WCSMA] workshop in 2006 and the tortoises conservation status assessment workshop and tortoise conservation plan development in 2008, with support from TFTSG [Tortoise and Freshwater Turtle Specialist Group]). Concerning local market sectors, value chain analysis of some species are underway such as the crocodile leather trade supplying the local market.

A.3.2. Flora sectors

Each year, the Plants Specialist Group from Madagascar (GSPM) conducts plants' conservation status assessments in collaboration with IUCN (cf. Chap 1, Part I). In 2005, 39 plant species were prioritized for value chain analysis and different studies were conducted to improve knowledge on flora values, such as the "Plant Resources of Tropical Africa" (PROTA), as part of building knowledge and promoting rural development.

This project works on useful plants of Tropical Africa. The Botanical and Zoological Park of Tsimbazaza hosts its Indian Ocean's islands regional office (Mauritius, Comoros, Seychelles, Reunion, and Madagascar). The project started in 2002 as a documentary research on grey literatures in the country's different documentation centers and established a database. As a result, books related to each group of plants, intended for farmers use, researchers, etc., were published.

During the final phase of the research on each group of plants, PROTA financed small projects to the benefit of farmers' groups, NGOs, and Institutions that came up with eligible projects. Objectives of the small projects are to highlight the positive impact of findings on rural development and to promote also family income. Then, two projects were funded: melon cultivation in the Middle-West and the domestication of tinctorial plants in Amoron'I Mania.

The Melon Cultivation project is implemented by a group of farmers in the region of Bongolava, in the middle-western part of the country. With PROTA's funding, a new melon cultivation technique developed by the CTHA, coordinator of this project, in Madagascar was transferred to farmers of the Marohazo Fokontany, Rural Commune of Sakay. These farmers were able to produce melons in a good quality and diversify their income-generating activities. With the extra income, they were able to construct a well, buy television sets, and pay the school fees of their children. These are parts of poverty reduction and rural development activities.

The tinctorial plants domestication project is implemented in the region of Amoron'i Mania. Aika (*Indigofera arrecta),* Bongo *(Danaïs ligustrifolia*), and Nato (*Labourdonnaisia madagascariensis)* are natural colorants heavily used by the region's weavers. The latter are faced with supply issues because Aika is a seasonal plant and Bongo and Nato are getting scarce. The objective of the project was to give weavers the possibility of finding these plants throughout the year.

With PROTA's funding, the Mondo Gusto Association collaborates with the Ankanin'ny Marary Ambositra (District of Ambositra) proceeded a) Aika domestication to make it available throughout the year and b) Nato and Bongo conservation by setting up a nursery. Seedlings will be reintroduced in the primary forest later on. This allowed both for conserving the species and helping weavers improve their family income (rural development).

B. VALUE CHAIN SUSTAINABLE MANAGEMENT

B.1. ADOPTION OF THE SUSTAINABLE MANAGEMENT SYSTEM

B.1.1. Legal framework

The following texts were promulgated as part of the species trade sustainable management, especially for threatened species:

- Act 2005-018 on the international trade of wild fauna and flora species (which defines international trade documents and procedures in conformity with CITES, reinforces the protection of non-CITES species (Wild flora and fauna), defines infringements of the international trade rules with precision and sets dissuasive penalties for offenders). The act was drawn up based on the CITES model law and Secretariat's recommendations. It was naturally adjusted to the national context, namely through the creation of an appendix 4th listing non- CITES species. Special actions and provisions are provided for this group of species, such as the requirement of an outgoing pass instead of CITES permits.

- Decree N°2006-097, setting the modalities of Act enforcement on the international trade of wild fauna and flora species (which defines the respective duties of the management body and the authorities and the nature of their relationships);

- Decree 2006-098 publishing the revised CITES appendices;

- The decree classifying wild fauna species (revision of the old decree in compliance with CITES Appendices, IUCN classification, and with consideration of the last information available on the status of Malagasy species). This list is currently being verified by scientific authorities before submission to the Government Council;

- The decree regulating the modalities of enforcement of Ordinance 60-126 of October 3, 1960, setting up the regime of hunting, fishing, and fauna protection.

B.1.2. Operation Mechanism

Code of Conduct: Act N°90.033 (1990) of the Environmental Charter and the national strategy for biodiversity management (2002) govern all laws related to biodiversity (including CITES). Requirement specifications or "cahier de charge" was established to refine the national policy regarding the international trade of wild fauna and flora species. They include operator obligations and may be subject to modifications, based on the results of the cost-benefit analysis.

The manual of procedures for the management of Madagascar's wild fauna and flora was finalized in January 2006. It sets formalities to be met to collect, transport, hold, and export specimens of wild species. Appendices include samples of the administrative documents to be filled in each specific case. This manual is a useful tool, not only for operators, but also for forest agents in charge of managing wild species in Antananarivo as well as in regions. The first section of this Manual can be already used by any individual wishing to get information on wild fauna and flora management in Madagascar.

Role of the scientific authority: the scientific authority has had legal existence since March 2003 (Ministerial Order is under revision based on Act enforcement and new decree previously mentioned) and has been fully operational since February 2004. It includes two units: the fauna scientific authority represented by the Animal Biology Department of the University of Antananarivo and the flora scientific authority represented by the Plant Biology Department of the University of Antananarivo. Each authority is comprised of scientists from universities or scientific institutions.

Transparency method for setting quotas: All experts from each fauna group (insects, amphibians, reptiles, birds, and mammals) met in April 2006 to draw up an objective methodology for setting quotas.
This methodology sets formulas based on different parameters: zone of occurrence, habitat, fragmentation, abundance, density, population size, etc. The data used are derived from the results of the field work conducted on each group in Madagascar. Prudent quotas are set when data is unavailable or deficient. This methodology for quota setting, established in 2006 is still valid and has not been subject to any modification.

Besides, to remedy to the problems linked with the operators' capacities, the Management Body (MB) and the fauna Scientific Authority (SA) decided to conduct a technical appraisal of each operator's reception infrastructures, prior to the annual distribution of quotas. Quotas are then distributed among the operators, based on the results of the centers' evaluation. The breeding centers evaluation grid was defined on the basis of the scientific authority and the management body criteria, which are subject to change.

B.1.3. Access and Benefits Sharing (ABS)

Benefit-sharing actions are being conducted under different projects, such as ICBG's bio-prospecting in the region of Diana, management transfer in throughout Madagascar and the baskets trade in Mahabo-Mananivo. In spite of these efforts, the evaluation of the national policy related to the wild species trade, conducted in support of CITES in 2007-2008 underscored the need of benefits' distribution improvement at the different stakeholders. To enhance these actions and promote equity in benefit-sharing, the national strategy for ABS is under finalization.

Box 4: Fair Trade of Baskets by the Women's Association in Mahabo- Mananivo (Source: Missouri Botanical Garden, www.blessingbasket.org)

Blessing Basket Project® is a non-profit organization which made its mission to reduce poverty through long-term employment and prosperity wages. Upon MBG's request, the organization brought its model to the basket braiders of the village of Mahabo (South-East of Madagascar), located on the South border of Mahabo forest. The partnership is aimed to improve economic conditions in support to MBG's local conservation efforts. The "Blessing Basket Project Prosperity Wages" remunerates the braiders of Mahabo five times higher, as part of Fair trade. The organization grants them a market in the USA, Canada, and Europe, through 125 retail points of sale. The results have been acknowledged throughout the world, including in Mahabo, says Theresa Wilson, founder and Executive Manager of the "Blessing Basket Project", based in Granite City, Illinois. Last year, the "Blessing Basket Project" injected the equivalent of USD450,000 in developing countries through the sale of more than 15,000 baskets. MBG noted that the first year's production will contribute to more than 10% of Mahabo's economy. Each basket is signed by a braider and contains a card describing the material used, the area where it was collected, and sometimes personal experiences of the braider. Prices range from USD30 to USD45, depending on the basket's size and style.

C. ECOTOURISM DEVELOPMENT

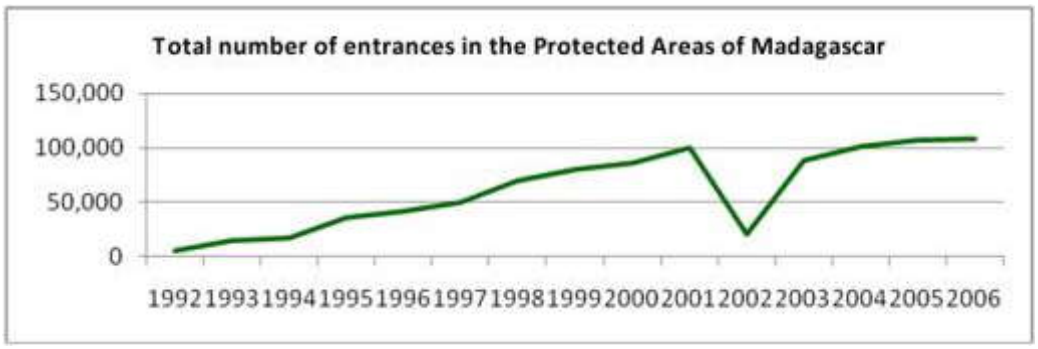
Ecotourism is the least destructive mode of ecosystem valuation known in Madagascar. Its development was started with the setting up of a protected areas network. In the recent years, it was noted that nature tourism out of protected areas developed, sometimes linked with environmental conservation objectives or benefit redistribution.

Table 28: Changes in the Number of Visits in Madagascar Protected Areas

	2002	2003	2004	2005	2006
Number of visitors in protected areas	21,344	88,159	101,102	106,692	108,294

Source: MNP

Chart 4: Total number of visitors in the Protected Areas of Madagascar



CHAPTER III

SECTORAL AND CROSS-SECTORAL INTEGRATION OR MAINSTREAMING OF BIODIVERSITY CONSIDERATIONS

Part I: Integration Mechanism

A worsening population poverty couple with the environmental degradation which sped up across the same period was illustrated by the rapid shrinking of the forest cover, from 25% of the territory in 1950 to 16% in 1995. This situation highlights that environment issues are linked to poverty.

Sectoral programs have been developed to integrate CBD objectives and principles, as in the case of the Rural Development Support Program or "Programme de Soutien au Developpement Rural" (PSDR) that includes Fishing, Energy and Mining, Tourism, and National Education sectoral programs.

I. SECTORAL LEGAL FRAMEWORKS

The table below describes policies, strategies, approaches, and activities related to CBD:

Table 29: Policies, Strategies, Approaches, and Activities that Linked to CDB

Fields	Plans /programs /strategies and projects related to CDB	Approaches /Activities linked to CDB
Global	-Decree creating the environmental unit at each sectoral ministry (c f. Part II) -Decree N°99-954 of December 15, 1999 amended by Decree N°2004-167 of February 03, 2004 on Making Investments Compatible with the Environment (MECIE) (cf. Part II)	cf. Part II cf. Part II
Agriculture and Livestock	-Land policy (Provisional version 2005) **Irrigation development plan** -Policy of catchment basins and irrigated perimeters development (2006) -National Strategy on Fertilizers (2006) -Rice farming development policy 2003-2010 -National Rural Development Policy (2006) **Madagascar Fishing Legislation** -Fishing Sectoral Program MAG/92/004 -Act N°2001.020 on responsible and sustainable fish farming -Decree N°94-112 on the general organization of maritime fishing activities -Decree 2004-169: activities and halieutic products collection in continental and brackish stretches of water on public and State lands **International convention** -Act N°2005-025 of November 02, 2005 authorizing the ratification of Madagascar's adhesion to the International Plant Protection Convention -Act N°2005 -042 of February 20, 2006 ratifying the International Treaty for Phytogenetic Resources for Food and Agriculture (TIRPAA) **Seeds** -Act N°94-038 of January 3, 1994 on seeds -Decree NN°2006- 618 August 22, 2006 on organizations in charge of implementing seeds policy **Sanitary protection of plants and plant products** -Ordinance N° 86-013 of September 17, 1986 on Phytosanitary Legislation in Madagascar -Act N° 86-017 ratifying Ordinance N° 86-013 of September 17, 1986, -Decree N°86-310 on the enforcement of ordinance N°86-013 of September 17, 1986 related to the Phytosanitary Legislation in Madagascar.	- Stabilize agriculture and improve t familial farms productivity ; - Guarantee the security land tenure in rural areas ; - Reorient agronomic research on satisfying sector needs; - Reinforce the agricultural information system; - Control water to ensure regular agricultural and animal production; - Restore Soils ; - Improve fallow lands using agro-forestry; - Manage aquatic environments in a sustainable way.

Source: ONE, 2009

Fields	Plans /programs /strategies and projects related to CDB	Approaches /Activities linked to CDB
Water	**Integrated Management of Water Resources** Act N°98.029: Water Code Decree N°2003/192 : ANDEA Decree N°2003.941: Surveillance of water intended for human consumption and access to resource Decree N°2003.943: discharge, drainage of wastes National Sanitation Policy/Strategy	- Satisfy water needs in sustainable manner; - Set up the institutional framework of sustainable and integrated management of water resources; - Implement Water Code; - Improve knowledge on water resources; - Build the capacities of management structures and stakeholders; - Set up sustainable and independent financing of the water sector; - Manage waters per catchment area; - Manage solid wastes of the domestic type, excreta (installation of latrines and sewage system), waste waters, and rain water - Ensure environmental conformity of infrastructures by prioritizing sites where environmental impacts are apparent or harmful effects are noted; - Create a service systematically controlling domestic, industrial, and mining sewage infrastructures within the Ministry in charge of the Environment.
Energy and Mining	**Energy policy** Act 96-019 of September 04, on Oil Code Act N° 98-032 of January 20, 1999: Reform of the electricity sub-sector Policy for developing renewable energies in Madagascar **Mining policy**: Act N°2005.021 : Mining Code Act N°2001-031 of October 08, 2002 setting special rules for large-scale investments in the Malagasy mining sector (LGIM) Decree N° 98-394 defining the mining policy Order N°12032/2000 on the regulation of the mining sector regarding environmental protection	- Save energy by using alternatives to traditional sources of energy: firewood, coal, fuel, etc. - Set up alternative sources of energy (solar, wind, biofuel) within rural communities - Transform Sakoa's coal for domestic uses - Improve the energetic efficiency of small-scale technologies by using biomass stoves (fatana mitsitsy) - Ensure optimal management of the sector and reduce structural inequity; - Enhance good governance and fight against corruption through this commitment.

Source: ONE, 2009

Fields	Plans /programs /strategies and projects related to CDB	Approaches /Activities linked to CDB
Transport	**Railway transportation** Reference to the "Environmental record of the rehabilitation program of railway system on the Northern line"	- Article II.18: Environmental preservation. - Appendix 3: Matrix of Environmental. Management Plan (charter of responsibilities and action plan), Environmental impact 16 and 25.
	Port, marine, and river transportation Act N°99-028 of February 03, 2000 restructuring the Maritime Code : Malagasy Maritime Code 2000	Chapter 9: Biological Resources Management and Conservation Chapter 10: Protection and preservation marine environment Preserve surrounding environment Control Air and water pollution Control soil degradation and erosion effect Reduce noises' harmful effects
	Civil aviation Act N°2004 – 027 of 09.09.2004 creating the Malagasy Civil Aviation Code: Article L1.5.1-1 of Title 5 – Environmental protection related to aircraft emissions of noise and harmful substances Annex 16 of the International Civil Aviation Organization (ICAO) – Environmental protection: engine noise Instruction N° 01 DG/DANA of 02.23.2007 defining the roles and responsibilities of all bodies in charge of preventing bird strike hazards on airfields	Identify means to fight against poisoning, shoots, captures , startling, etc in collaboration with the airport and forest services; . Conduct ornithological studies
	Road transportation Interministerial Order N° 6941/2000 setting a threshold for the cars' emission of exhaust fumes and repealing the provisions laid down in Order N° 1186 of March 26, 1971	Article 1: Enforce regulations related to the cars' emission of exhaust fumes and setting limits of acceptable emissions
Health	National policy of hospital waste management (2005) Decree N°805-2007 of August 21, 2007: recognition of the traditional medicine practice	Manage hospital wastes Raise awareness to traditional practitioners

Source: ONE, 2009

II. OPERATION MECHANISM

The operational intervention mechanism builds on the environmental units of the Ministries and intersectoral platforms.

A. ENVIRONMENTAL UNITS

Environmental units, created at each sectoral Ministry by Decree n°2003-439 of March 27, 2003, are in charge of:

A.1. REGULATORY MATTERS

- Enforce legislative and regulatory texts regarding environmental management;
- Propose and/or contribute to the development and enforcement of texts aiming to integrate environmental dimension to their respective Ministry;
- Harmonize their sector's regulations with environments and ensure that sectoral procedures are compatible with the environmental ones as well.

A.2. TECHNICAL MATTERS

- Participate to the National Environmental Policy implementation by ensuring environmental promotion and management in their own sector of activity;
- Promote better use of renewable natural resources in the relevant sector of activity;
- Promote the control of pollutions, harmful effects, and wastes deriving from appropriate sector's activities;
- Promote environmental education actions among the decentralized governmental services agents;
- Contribute to the risks of environmental degradation identification and propose mitigation, compensation, and prevention measures in the relevant sector of activity;
- Contribute to the development of technical tools for environmental management (standards, guides, etc.);
- Ensure control and monitoring of the environmental aspects of the relevant sector's activities;
- Ensure the management of complaints and all environmental issues related to sector of activity in collaboration with other competent authorities;
- Participate to the different committees or other groups of environmental reflection works;
- Represent their respective Ministry within the ad hoc Technical Evaluation Committee (CTE) to whom the MECIE decree has entrusted the Environmental Impact Assessment (EIA) proposals. However, if necessary, Environmental Unit may resort to the competencies of its Ministry or related organizations;
- Evaluate Environmental Commitment Program (ECP) proposals relevant to their Ministry, in compliance with the provisions of the MECIE decree created.

A.3. COMMUNICATION MATTERS

- Ensure the dissemination of environmental information within the ministry as well as among other authorities and partners involved in environmental management;
- Enhance communication synergy among the sector and different entities involved in environmental management.

B. INTERSECTORAL STRUCTURES AND PROGRAMS

Platforms were set up to address specific issues of the environment sector and other sectors, with the objective of facilitating the integration of environmental concerns with the sectors' development. While some of the platforms are permanent ones, others are ad hoc.

The "Environmental Units Platform" serves as interface for environmental authorities, other sectoral Ministries, decentralized structures, operators, and other partners and offers support and advice on the environmental issues relevant to each Ministry concerned.

There are currently two permanent platforms, the Mining-Forests Commission and the Forest-Fishing Commission. For the National Protected Area creation process, both commissions were created to mitigate conflicts related to the population's (immediate) needs, the communities' and actors' perception, and the use of space and resources (e.g. land conflicts, the populations' priorities in a context of poverty).

Intersectoral programs and projects include, among others:

- The Action Plan for Rural Development or " Plan d'Action pour le Developpement Rural" (PADR), which is a framework guiding the design, definition, and orientation of rural development strategies and programs in Madagascar and the National Rural Development Program (PNDR), which is the basic reference document of all rural development programs and projects;
- The Erosion Control Program or "Programme National de Lutte Anti-Erosive" (PLAE), which contributes to upholding rice production bases by protecting catchment areas surrounding rice farming plains in collaboration with the relevant population to reduce the sanding of the peripheral channels and rice fields. The program has been working in five (5) regions of Madagascar since 2004;
- The National Catchment Areas and Irrigated Perimeters Program or " Programme National des Bassins Versants et Perimetres Irrigues" (BVPI), which aims to durably improve the living conditions and rural population incomes in catchment areas by integrating irrigated perimeter areas; this program also ensures better valorization and preservation of natural resources for the whole country's benefit. The program is implemented in four (4) districts. The current phase started in 2007;
- The Project to Support Rural Development or "Projet de Soutien au Developpement Rural" (PSDR), whose objectives are to increase income and reduce poverty in rural areas while preserving basic natural resources;
- The Pole of Integrated Growth Project or "Projet Pôle Integré de Croissance" (PIC), which combines activities that promote private sector development, construction and rehabilitation of key infrastructures in poles of growth, and capacity building of local associations, while considering social and environmental components. Although renovated infrastructures may have huge economic impacts, environmental and social impacts have been forecasted and will be monitored throughout construction. An Environmental Management Plan has been developed for each PIC building site. The PIC is focused on three flourishing poles and sectors: Nosy-Be (e.g., tourism), Taolagnaro (e.g., mining, tourism), Antananarivo-Antsirabe line (e.g., new information technologies, food processing, industry); and
- The Mineral Resources Governance Program or "Programme de Gouvernance des Ressources Minerales" (PGRM), which aims to support the Government in implementing the strategy to accelerate sustainable development and poverty mitigation in Madagascar. PGRMs are conducted through the reinforcement of transparency and governance in mineral resources management with special support to small-scale mining and crafts exploitations. PGRM specifically aims to improve the management of natural resources and prevent environmental degradation.

C. MAKING INVESTMENTS COMPATIBLE WITH THE ENVIRONMENT (MECIE)

The MECIE decree (decree n° 99954 on December 1999 modified by the decree n° 2004-167 of February 03, 2004) is a legal instrument requiring public or private investors to perform an Environmental Impact Studies (EIS) when their investments can potentially harm the environment, in application of Art 10 of the Environmental Charter.

C.1. ENVIRONMENTAL ASSESSMENT, ENVIRONMENTAL COMMITMENT PROGRAM, AND ENVIRONMENTAL COMPLIANCE

C.1.1. Environmental Impact Study (EIS) or "Etude d'Impact Environmemtal" (EIE)

(cf. Art 4 [new one] and Appendix I of decree):

Investment projects that may have large-scale impacts on the environment or located in sensitive areas are subject to the following prescriptions:

- performing an environmental assessment by the Promoter;
- obtaining an environmental license delivered by ONE pursuant to EIS's favorable evaluation by an ad hoc Technical Evaluation Committee; and
- delivering the Project's Environmental Management Plan or "Plan de Gestion Environmental du Projet (PGEP) which forms the project's environmental record.

C.1.2.Environmental Commitment Program (ECP) or Programme d'Engagement Environnemental" (PREE)

(cf. Art 5 [new one] and Appendix II of decree):

Investment projects having lesser potential effects on the environment are subject to the following prescriptions:

- Implementing an Environmental Commitment Program by the investor. The content, admissibility conditions, and modalities of enforcement are defined by official regulations and the transitional provisions of the present Decree;
- Obtaining an Environmental Authorization delivered by the relevant sectoral Ministry and pursuant to the ECP's favorable evaluation by the Environmental Unit who will draw up and forward the relevant reports to the Ministry in charge of the environment and ONE.

C.1.3. Environmental compliance or "Mise en Conformité" (MEC)

(cf. Art 38 [new one] to 42 of decree):

Existing companies will follow the procedures of an EIS or an ECP, as any ongoing investment must align with the guidelines and standards of environmental rational management and achieve environmental compliance either through an EIS or an ECP. A MEC process guide is available at the National Office of Environment or at www.pnae.mg.

Certificate of Compliance or Environmental Approval: depending on the case, the administrative act will be delivered either by the National Office of Environment (i.e., certificate of compliance) or the Ministry supervising the activity (i.e., environmental approval), after receiving technical approval from the Technical Evaluation Committee (TEC) on the EIS or the relevant Environmental Unit's approval of the Environmental Commitment Program (ECP).

The Promoter will be released of its environmental liability only at the project's end, upon obtaining of the environmental final discharge. The final discharge is the administrative act of approval that the competent body, which also granted the environmental license, issues to acknowledge the completion, acceptability, and exactness of the rehabilitation works conducted by the promoter.

The MECIE decree does not consider the "Strategic Environmental Evaluation" notion which applies to Plans, Programs, and Policies and requires submission of evaluations following the same procedure as environmental impact studies. This gives rise to a legal imprecision that should be corrected by the State.

C.2. MONITORING AND SUPERVISION OF THE PROJECT'S ENVIRONMENTAL MANAGEMENT PLAN (PEMP)

The PEMP, which is delivered with the environmental license in the form of Environmental record, aims to describe the surveillance and monitoring activities required to ensure the implementation of the environmental measures recommended in the Environmental Impact Study (EIS) of the project, check its results, and evaluate its soundness. "Environmental measures" refer to the measures of elimination, mitigation, and compensation of the project's impacts on the social and natural environment. The PEMP complies with the Malagasy regulations, as they apply to the Project, as per the provisions of the Establishment Convention. The relevant provisions of MECIE, the Mining Code, and the Interministerial Order N° 12032/2000 are specifically referenced. The Order lists the elements that a Project's Environmental Management Plan must include. It defines the PEMP as "a program for implementing and monitoring the measures laid down in the environmental assessment to avoid, suppress, mitigate, and eventually compensate for the project's detrimental consequences on the environment."

The PEMP's implementation requires that the promoter enforce the measures prescribed to avoid, mitigate, and eventually compensate for the project's detrimental effects on the environment, throughout the life of the project.

The monitoring of the PEMP's implementation includes tracking changes in the environmental status as well as the efficiency of mitigation measures and other provisions recommended by the same PEMP.

Evaluating the PEMP's implementation aims to ensure that the promoter keeps his/her commitments and obligations, as defined in the PEMP and throughout the project's cycle and entails taking sanctions in case of non compliance. The table hereafter lists the institutions concerned by MECIE and their respective roles.

Table 30: Institutions concerned by MECIE and their roles

Institutions concerned by MECIE	*Roles*
Ministry in charge of the Environment	Client throughout the whole environmental evaluation process and proposal management.
National Office of the Environment (ONE)	Ensure enforcement of the MECIE decree as part of the Environmental Impact Studies under the supervision of the Ministry in charge of the Environment.
Environmental Units at different levels	Participate in EISs evaluation during the different phases of the process as Technical Evaluation Committee (TEC) members and ensure the evaluation of ECP p roposals.
Decentralized territorial structures	Communes affected by the project are consulted during public evaluations. They organize and/or take part in procedures for the public's participation in environmental assessments (e.g., CDP, EP, and AP). They may also participate in the technical evaluation of the environment as resource people upon TEC's request and are associated to the project's supervision and monitoring.
Decentralized administrations	Regional environmental units participate in th e EISs' evaluation; ensure control of requirement specifications or "Cahier de charge"' effectiveness, and the monitoring of changes in the environment hosting the project in each region. They are organized in Regional Environmental Committees when monitoring "large-scale projects" Regional environmental administrations representing the Ministry in the appropriate region.
The Regional Environmental Liaison Committee	Build on the population's participation in monitoring. Collect information and raise awareness towards progress status of large-scale projects in the region concerned. Ensure processing and information dissemination from the population and all projects having potential impacts on the environment.
The Regional Committee Managing Environmental Claims	The committee is a design, sensitization, and negotiation structure which aims to efficiently address environmental claims at the local level. It is also in charge of the management planning of proximity claims as part of effective decentralizatio n.

Source: ONE, 2009

C.3. ORDER ON SENSITIVE ZONES (cf. Order n° 4355/97 of 05/13/97 defining and delineating sensitive zones)

The notion of "sensitive zones" is integrated to the MECIE decree to provide guidance for performing an EIS for any setting up or modification of developments, structures, or works that are located in sensitive zones (Art 4) or may affect them (Annex I).

Art 2 defines a zone as sensitive when:

- it includes one or several elements of biological, ecological, climate, physical and chemical, cultural, and social and economic nature; and
- it has a specific value or a certain vulnerability to human activities and natural phenomena that may modify these elements and/or degrade or even destroy the zone.

Types of sensitive zones are defined in article 3 and include: coral reefs, mangroves, islets, tropical forests, areas subject to erosion, arid or semi-arid areas subject to desertification, marsh areas, natural conservation areas, protection perimeters of safe, mineral, or underground waters, paleontological, archeological, and historical sites as well as their perimeters of protection.

As such, areas that support protected species are considered as areas of natural conservation, and as areas of natural conservation, protected areas are classified as sensitive zones.

Picture 10: Environmental Impact Assessment of the Ambatovy Mining Project. by the Conservation International

Part II: Achievements

I. CONSIDERATION OF BIODIVERSITY IN ENVIRONMENTAL EVALUATIONS

Some tools were developed and are available to enforce MECIE: the General Guideline for Conducting an Environmental Impact Assessment, the Environmental Evaluation Guide, the Environmental Compliance Guide (MEC), the Environmental Audit Guide, the ESE Guide (for sensitive areas and wetlands), the Guide for Decentralized Territorial Collectivities, and EIS guides on specific sectors such Tourism, Roads, Fish farming, Oil (upstream), Logging, and Open-cut Mines.

The Environmental Strategic Evaluation (ESE) is a voluntary process for programs and policies to follow. E.g., the environmental strategic evaluation process which allows defining important biodiversity areas of Madagascar Protected Areas System: the ESE of the regional development scheme of Anosy Region which resulted in the development of fourteen (14) regional environmental prescriptions documents and finalization of those of the other regions is planned for 2009.

Partnerships were built to encourage promoters to perform environmental evaluations, such as the case of the partnership between ONE and bank agencies: the screening of each request for credit was performed to determine the level of environmental evaluation required.

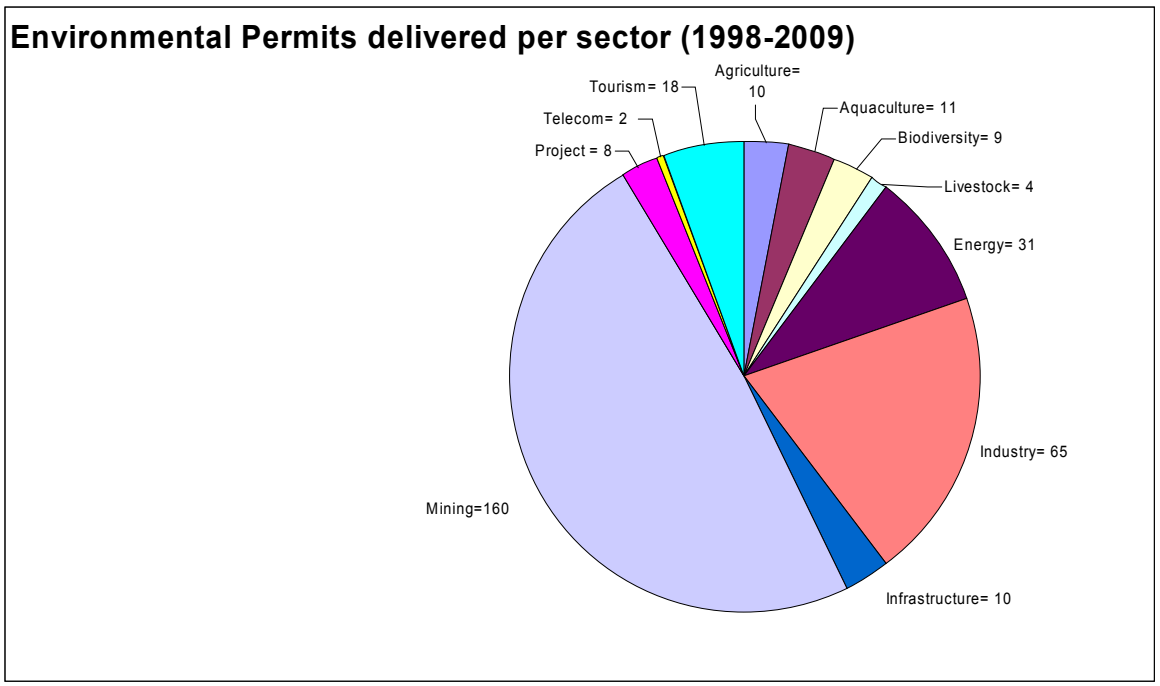
Ten years after the issuance of the decree, investors are willing to abide by legal requirements, as expressed by the annual increase of the number of applications for environmental license submitted at the National Office of the Environment (ONE).

Table 31: Change of the number of environmental permits delivered

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Number of applications submitted	**14**	**21**	**13**	**21**	**44**	**45**	**72**	**58**	**87**	**28**	**427**
EIS	12	19	11	14	32	37	68	52	79	24	**368**
MEC	2	2	2	7	12	8	4	6	8	4	**59**
Permit delivered	**16**	**14**	**9**	**20**	**19**	**36**	**61**	**63**	**60**	**33**	**344**
EIS	15	13	8	14	14	28	49	57	57	28	**292**
MEC	1	1	1	6	5	8	12	6	3	5	**52**

Source: ONE - 2009

Chart 5: Environmental Permits Delivered per Sector (1998- 2009)



Source: ONE, 2009

The data and information related to the environment are compiled in the Environmental Dashboard (EDB) or "Tableau de Bord Environmental" (TBE) which is a set of environmental indicators that gives an overview of the environmental status: results related to climate change impacts, continental waters, coasts, soils and vegetation cover, and biodiversity. It is a decision-making tool developed under the Malagasy Environmental Program. 17 out of 22 regions have an environmental dashboard. The national EDB has been updated twice since 2002 (www.pnae.mg).

II. ACHIEVEMENTS PER SECTOR

Each sectoral Ministry's environmental unit contributes to MECIE decree enforcement through activities such as: EISs, representation of the Ministry within the Technical Evaluation Committee (TEC), supervision and monitoring of environmental specifications requirement.

A. TOURISM SECTOR

One of the commitments made by the Ministry of Tourism consists in promoting the development of tourism and ecotourism that protects and preserves the natural environment and the social and cultural identity of Malagasy citizens. This commitment directly contributes to biodiversity conservation.

A.1. Projected Actions

- Align the Tourism sector's regulations and sectoral procedures with environmental requirements; Ensure the dissemination of intra-ministerial environmental information to authorities and partners involved in environmental management.

A.2. A

- Eco-tourism standards implemented in collaboration with MNP and ONE;
- Development of the Green Label, initiated by ONE and the Ministry of Environment and Forests Continued; and

- Regional Tour operators contribute to environmental protection program and the enforcement of applicable texts.

B. EDUCATION AND SCIENTIFIC RESEARCH SECTOR

B.1. EDUCATION

The Educational Policy Related to the Environment (EPRE) or "Politique de Education Relative à l'Environnement" (PERE) of the Malagasy Government is enforced through close collaboration between the Ministry of Education and Scientific Research and the Ministry of Environment and Forests.

B.1.1. Projected actions

- Implement decree 2002-751 setting the EPRE
- Train trainers on the exact definition of the environment and relevant methodology; and
- Enhance practical activities in arts centers on environmental education.

B.1.2. Achievements

The following were achieved based on collaboration of national and international institutions and NGOs, and various environmental education programs and projects:

- Environmental dimension Integrated to school syllabus;
- Environmental Department available in most Universities in Madagascar;
- Regional trainers' trainings on environmental education performed at Arts and Environmental Education Centers in the 22 regions;
- Pedagogical kits and summaries of the Regional Environmental Dashboard (REDB) and various educational documents conveying environmental topics (illustrated in Malagasy such as "IMANANKASINA") published;
- Environmental issues and proposed solutions identified;
- Teachers and soldiers trained on environmental practical actions;
- Tools for environmental education developed: EPRE training modules, including "The notion of natural resources sustainable management", "Environmental issues", "Lessons guide on using Teaching Materials", "Creative figurines in papier mâché" , "Using and developing the MAD'ERE kit for informal and formal education";
- A pilot project to support the Regional Promotion of Education for Environmental Management (ARPEGE) implemented by the four ACP countries member of IOC (Comoros, Madagascar, Mauritius, and Seychelles) to solve environmental sustainable management problems, in a context of permanent and alarming degradation.

B.2. SCIENTIFIC RESEARCH

B.2.1 Projected actions

Integrate the Environmental Unit to the implementation of the "Valorizing Research" Program.

B.2.2. Achievements

- Different Departments within MENRS informed about the integration of the environmental dimension;
- A collaboration among researchers established in the form of information exchanges and communication;

- Project to extend handicapped people's rights in the school of the environment (June 2006-February 2007) implemented; and
- The Convention between the Ministry of Education and Scientific Research and GDRI in Tsimbazaza implemented.

B.3. THE NETWORK CONSERVATION OF EDUCATORS AND PRACTIONNERS (NCEP) or RESEAU DES EDUCATEURS ET PROFESSIONNELS DE LA CONSERVATION (REPC)

B.3.1. Projected actions

NCEP is a triennial project in its second phase spanning from 2008 to 2010, led by the American Museum of Natural History (AMNH), Conservation International (CI), Wildlife Conservation Society (WCS), and Durrell Wildlife Conservation Trust (DWCT), and funded by the MacArthur Foundation. The network counts more than 950 members from all over Madagascar and from 187 institutions including governmental organizations, public and private universities, conservation and development NGOs, and various associations working in the field of education and/or biodiversity conservation. Its main activities include:

- Setting up a platform of exchange between biodiversity conservation practitioners and educators/trainers;
- Developing and disseminating biodiversity conservation syllabus; and
- Expanding the network by implementing resource centers at the level of the decentralized collectivities where the six universities of Madagascar are located.

B.3.2. Achievements

- 31 course modules distributed under five topics developed: basic notion of biodiversity conservation, biodiversity crises, natural resources management, marine conservation, and conservation planning tools;
- 46 professional trainings and mini-trainings on specific topics for regional groupings carried out on created and adapted to the Malagasy context modules;
- Seven topic-related support provided to "pilot" institutions involved in the integration of the Network Conservation of Educators and Practitioners (NCEP) modules to their curriculum;
- 631 PECN members received training from 2004 to 2008.

C. HEALTH SECTOR

Integration of the environmental dimension by the Ministry of Health was evidenced by the following achievements:

C.1. HEALTH ENVIRONMENT SERVICE

C.1.1. Ecosystem Approach

- For evergreen dense rainforest (EDRF) of Eastern Madagascar: Health sector participated to the validation of the environmental management plans for Makira protected areas creation in the Regions of Sava, Sofia, and Analanjirofo;
- Concerning the dense dry deciduous forest (DDCF) of the West, the health sector involved in the Exxon mobile project implementation (April 2008).

C.1.2. Standardizing of waste management equipments in health facilities

- The national hospital waste management policy developed (2005);

- Incinerators of the Montfort type setting up at 19 public hospitals (DHC1 Andramasina, Ambatomainty, Betioky-Sud, Mahabo, DHC2 Sainte Marie, Antalaha, Nosy be, Bezaha, Mananjary, Ifanadiana, Antalaha, Moramanga, RRHC Sambava, Morondava, Maintirano, Antsohihy, Ihosy, Ambovombe, and Taolagnaro) in 2009.

C.1.3. Multipartite Collaboration

(Collaboration among the Ministry of Health, the Ministry of Environment, and the Ministry of Defense for the destruction of expired medicines.)

C.2. PHARMACOPEIA AND TRADITIONAL MEDICINE DEPARTMENT UNIT

- Decree N°2003-1097 on the regulation of medicinal plants' sale, manufacturing and sale of medicinal products of plant origin created;
- Basic health centers informed and trained on the use of medicinal products of plant origin (cf. Appendix on health centers trained and using medicinal products of plant origin);
- Pharmacopeia and traditional medicine health workers' capacities improved: Master in traditional medicine created in 2007 (two-year training, 19 graduate students in 2009).

C.3. INTEGRATION OF MEDICINAL AND AROMATIC PLANTS IN PUBLIC HEALTH PROMOTION

Integrating the use of medicinal plants within modern medicine practice is being promoted by the Ministry of Health. Research on medicinal plants and on the scientific manufacturing of medicinal plant products from revised traditional manufacturing methods were conducted within the different pharmaceutical research centers and institutions, such as the National Center of Applied Pharmaceutical Research or " Centre National d'Application de Recherche Pharmaceutique" (CNARP), the Malagasy Institute of Applied Research or Institut Malgache de Recherche Appliquee" (IMRA), and Homeopharma.

Currently, affordable medicinal products made from Malagasy plants are available at IMRA and Homeopharma for public health promotion. 40 medicinal products made from Malagasy plants developed by IMRA.

Small collections of medicinal plants can be found in different institutions, more or less specialized parks or gardens or a few specimens for research purposes (CNARP, PBZT, and IMRA). They have generally been collected in situ. For instance, CNARP currently has 110 acclimatized species, 34 of which are endemic.

A few economic operators connected with CNARP cultivated aromatic and medicinal plants. COREMA Companies are based in Marovoay Moramanga; PROIMPEX in Andasibe; SIMPEXMA has successfully been cultivating *Catharanthus roseus* over more than 4ha since 1989. Unsuccessful cultivation trials were performed in other regions with other plants (e.g., *Catharanthus* in Fianarantsoa).

Integrating the use of medicinal plants in public health must go along with some reinforcement of these plants' rational management through ex-situ conservation activities. Plants that benefit from ex-situ conservation currently represent an insignificant proportion (less than 0.5%) of medicinal plants as a whole. Existing of living plant collections are overall very poor and far from being comprehensive.

D. AGRICULTURE, LIVESTOCK, AND FISHING SECTORS

D.1. AGRICULTURE SECTOR

D.1.1. Description of the Means and per-Ecosystem Approach Adopted by the Sector

- Dissemination of agricultural seed varieties adapted to a diversity of ecosystems: According to the Seeds Program (PGROSEM), fast growing seeds for the Southern bush ecosystem and seeds resistant to fungal diseases for the evergreen dense rainforest (EDRF) of Eastern Madagascar disseminated, training on seeds conservation and production and grants for infrastructure provided (completed in 2000);
- The Project to Support Rural Development (PSDR) funding sub-projects according to the potential resources to address promising sub-sectors as identified by farmers' and/or professionals' associations in the 22 regions of Madagascar;
- PPI or Irrigated Perimeters rehabilitation Program (1988-2000), currently taken over from by the Catchment Area/Irrigated Perimeters Program (BV/PI), which specifically uses improved varieties of rice and conducts research on phytogenetic resources for food and agriculture (PGRFA) in four target sites, Andapa, Itasy, Alaotra, and Marovoay;
- In January 2008, the Ministry of Agriculture, Livestock and Fishing (MAEP) developed an Agricultural Sectoral Program (PSA), a translation of the agricultural sectoral policy paper for operational purposes. As a whole, this program aims to modernize agriculture in Madagascar by improving key stakeholders' agricultural development performances. It is based on a value chain and public-private partnership approaches (approaches that need to be promoted in the field).

D.1.2. Results per Objective

Concerning food crops, valorizing local ecotypes ecologically and socially adapted to the different regions contributed to food security, sustainable management and use of PGRFAs, and sustainable agriculture (cf. MAEP Annual Report).

D.1.3. Crops Improvement and Food Security Program

The food crops improvement program is more focused on rice. Before Madagascar's independence in 1960, the program aimed at improving rice production within large-scale farms, especially perimeters that have enough water. For 20years or so now, ongoing use of local varieties crossed with introduced ones has allowed for obtaining:

- Varieties specifically adapted to the different types of rice farming as characterized by their water management mode, type of soil, tolerance of salinity, tolerance of cold at the cycle's beginning and end, and resistance to diseases (RYMV, Pyriculariosis, etc.). This allowed the Malagasy agriculture to address some climate, edaphic, and pathological issues and to a certain extent, improve food security;
- Early varieties or "varieté precoce" allowing for double crops or earlier availability of rice fields for off-season crops that will shorten the lean period and yield products alternative to rice;
- Competitive export products on the international market (long-grain rice, red rice, perfumed rice), which generated income for producers and granted them means to buy food.

At present, FIFAMANOR's (Malagasy-Norwegian Cooperation for Livestock and Agriculture Development) program for improving crops is based on genetic and agronomic research combined with an evaluation program. Although biotechnologies have been used for certain species – for instance, the haplomethod on rice and induced mutagenesis for cassava and oats – conventional crossing is still commonly used. Crop improvements, among other strategies, aim to improve agricultural yield, and thereby contribute to food security.

As regards cash crops, since 1997, CTHT (Technical and Horticultural Center of Toamasina), an inter-professional association of producers, operators of the para-agricultural and food processing sectors, and downstream subsector interveners, produces and disseminates improved plant material such as litchis, mangosteens, grenadillos, pink peppercorns, pepper plants, and clove trees. Other professional organizations such as CNCC (National Coffee Marketing Committee), GNEV (National Vanilla Exports Group), and CTHA (Technical and Horticultural Center of Antananarivo) make large contributions to crop development: introducing varieties of onion or groundnut, coffee operation, technical support, and coordination of the different economic actors to improve the products' quality and to increase the quantities exported.

Concerning cultivated plants that are from wild plants, the genetic improvement program is based on crossing such as the case of rice and coffee. However, for farming new species, domestication is required, especially for those used for food (rice, sweet potato).

Regarding forest phytogenetic resources, in agroforestry, the forest species planted alongside food crops protect soils and help maintain the hydrological regime. It contributes to sustainable agriculture while protects the physical natural resources for production.

a) Projected Actions

In addition to the environmental unit's activities (cf. Part 1, Operation structure) it is also planned to:

- Implement the International Treaty for Phytogenetic Resources for Agriculture and Food or "Traité International sur les Ressources Phytogenetiques pour l'Agriculture et l'Alimentation" (TIRPAA); and
- Set up an intersectoral national technical committee.

b) Achievements

- Participated in aligning sectoral texts and procedures into the environmental legislation;
- Provided comments in the provincial order for the consideration of the Onilahy valley as a protected area to enforce decree n°4355/97 relating to sensitive zones;
- Showcase sites with instructions on catchment areas protection identified and implemented in the Rural Development Regions; and
- Participated to the evaluation of the ECP of the Agricultural Mechanization Training and Application Center (CFAMA) of Antsirabe: development of environmental requirement specifications and delivery of the Environmental Approval.

D.2. FISHING AND HALIEUTIC RESOURCES SECTOR

D.2.1. Projected Actions

- Contribute to the MECIE enforcement;
- Monitor the UNEP project related to the impact assessment of agricultural products marketing policies on biodiversity: case of the shrimp in Madagascar;
- Protect and conserve coastal and marine ecosystems;
- Conduct fishing control; and
- Manage halieutic resources in sustainable manner.

D.2.2. Achievements

- Contributed to the amendment of the decree governing imports and use of ozone-depleting substances (ODS);
- Technical and financial support provided to the Erosion Control Program or " Programme de Lutte Anti-Erosive" (PLAE);
- The Regional program for sustainable management of the Indian Ocean countries' coastal areas (ProGeCo) transferred to the relevant DRDRs;

- Fishing data for the clearing-house mechanism (CHM) of the Nairobi convention fed and updated;
- Contributed to the orientation and monitoring of the ACCA (Adjusting to climate change in Africa) /CRDI project;
- High-level training on Environmental monitoring and the integration of the environment into development cooperation received;
- Participated to the development of the second National communication as part of the Kyoto Convention (UNFCCC, United Nations Framework Convention on Climate Change) ;
- A project for the integration of environmental issues and *tavy* stabilization in MAEP's development programs developed, under the MAP Commitment 4; and
- The Ecosystem Approach in Fishing (EAF) project in Madagascar initiated with FAO collaboration;

D.3. LIVESTOCK SECTOR

D.3.1. Projected actions

Develop and/or update legislative and regulatory texts integrating the environmental dimension.

D.3.2. Achievements

- Participated in the planning of the development of the National profile for chemical management;
- Contributed to the implementation of the "Integrated evaluation of the impacts of marketing policies on biodiversity: case of the shrimp trade in Madagascar.

E. ENERGY AND MINING

The Ministry in charge conducted a current situation analysis to define actions needed to mitigate environmental degradation:

E.1. ENERGY SECTOR

E.1.1. Actions projected

- Conduct transfer of forest resources management for energy purposes;
- Perform reforestation for energy purposes;
- Improve carbonization yields by disseminating improved carbonization techniques of (yield increases from 8% to 18-20%);
- Substitute firewood with other sources of energy (ethanol, solar energy, etc.);
- Promote energy from agro-industrial products; and
- Develop and promote energy-saving cooking equipment using firewood and charcoal.

E.1.2. Achievements

- Promotion of renewable energies to replace traditional ones: the degradation of forest resources decreases conversely to the number of improved stoves extended and the use of charcoal drops off to 50%; and
- Rigorous enforcement of the provisions of texts, COAP (Protected Areas' Code) and MECIE.

Collaboration between Energy-Forests-OMNIS-NGO should be set up to propose texts to govern research, with consideration of environmental issues.

E.2. MINING SECTOR

Besides achieving integration of the environmental license award process to mining, the per-ecosystem approach is characterized by the sector's involvement in local consultations for setting up the new protected area (NPA) of the Forest Corridor of Fandriana Vondrozo (FCFV), under the lead of the Madagascar Protected Areas System (MPAS), in the evergreen dense rainforest (EDRF) of the East.

E.2.1. Projected actions

Contribute to the enforcement activities of MECIE decree.

E.2.2. Achievements

- Contributed to the improvement of Mining-Forest Inter-ministerial Orders;
- Texts addressing environmental issues in gold washing or artisanal mining established;
- A framework of an environmental monitoring book for small miners published in Malagasy and French version PEE-PREE: 441, PEE-RIM: 38, and PEE-RS: 12, EIE:35;
- Environmental monitoring performed within 24 sites;
- Posters and brochures on the environmental management of small mines established;
- Advice on PEE-PRE and PEE-RIM for operators upon request:
  - Reminder of the Communes' role in environmental management;
  - Reception, information, and supervision of Mayors or representatives of territorial collectivities requesting help on the mining environment.
- Participated in local consultations on the setting up of the new protected area (NPA) of Fandriana Vondrozo;
- Contributed to the design of GEIS according to regulatory texts.

F. WATER SECTOR

Pursuant to the World Summit on Water and Environment in Rio in 1992, the implementation strategy for water conservation as stipulated in the Water Sectoral Policy consists in:

- Adopting the Water Code in 1999, followed by its decrees of enforcement (Act N°98-029);
- Enforcing the Water Resources Integrated Management (GIRE) principle in accordance with the principles stated during the Conference of Dublin in 1992.

ACHIEVEMENTS

- The National Water and Sanitation Authority (ANDEA) created by the decree N°2003-191 to implement Integrated Management of Water Resources (GIRE), coordinate water resource conservation and protection actions in all sectors: improve knowledge of water resources and manage water within catchment areas in a sustainable way;
- Watershed Agencies and Catchment Area Committees created all over the country;
- Enforcement of GIRE: reinforcement of water pollution control, implementation of participatory water resource management, and enforcement of the "polluter pays" principle;
- A National Sanitation Policy and Strategy (PSNA) established. Direct intervention with operators: creation of the Environmental Unit;
- Monitoring and Assessment system established and implemented.

G. PUBLIC WORKS AND METEOROLOGY SECTOR

In terms of per-ecosystem approach, the Public Works sector is involved in the environmental assessment of mines in the evergreen dense rainforest (EDRF) of Eastern Madagascar. In addition, training of agents for environmental actions in favor of the Southern bush's ecosystem has been performed.

As agreed in the decree creating the environmental unit within the Ministry and the MECIE decree, the Ministry in charge of Public Works and Meteorology provided efforts to integrate the environmental dimension to its sector by implementing the action plan of the Environmental Impacts service.

Significant achievements include:

- Public awareness on Social and Environmental Impacts Management conducted with regional officers;
- Participated in the evaluation of Environmental Impacts Studies and delivery of environmental permits to different mining projects such QMM, Ambatovy Project, CANDAX Project, seismic exploration on unit 1101 in Ambilobe at the level of the road works site area (RN6), MAINLAND MINING Project, Mining and exports of 125,000,000 tons of ilmenite over a five-year period, and other Projects;
- Burrow sites restored along dirt roads;
- Treatment of environmental liabilities: Management of quarry site restoration works; and
- Environment Community Animators (ECA) from pilot communes trained.

H. ECONOMY, TRADE, AND INDUSTRY SECTORS

H.1 TRADE SECTOR

H.1.1. Projected actions

- Enforce regulatory texts relating to environmental management;
- Align the trade sector's regulations with those of the environment;
- Develop the text to integrate the environmental dimension into the Ministry in charge of trade;
- Build the capacities of the Environmental Unit;
- Promote environmental education with decentralized service agents.

H.1.2. Achievements

- Contributed to the implementation of the Decree relating to Ozone protection;
- Amendment of the regulatory text on food products' customs clearance;
- Participated in the evaluation of the CITES Policy;
- Involved in the project "Integrated evaluation of the shrimps trade impact on biodiversity";
- Contributed to the collection of data on Persistent Organic Pollutants (POPs) as part of the "Strategic Approach to International Chemical Management" (SAICM);
- Decree on "Commerce Equitable et Solidaire "(CES) or Fair Trade drafted;
- The "WATERLILY" association's activities in domestic waste management monitored and supervised;
- Progress enforcing texts on eco-labeling and packaging; and
- Awareness raising of Fair Trade actors in 14 regions performed.

H.2 INDUSTRIAL SECTOR

H.2.1. Projected actions

- Enforce Multilateral Environmental Agreements;
- Develop the text pertaining to solid wastes;

- Develop a Bill creating the national policy for chemical management;
- Enforce the MECIE decree;
- Officially approve pesticides and Agro-pharmaceutical products;
- Ensure environmental compliance of companies (Persistent Organic Pollutants [POPs]); and
- Raise awareness on the use of Renewable Energies.

H.2.2. Achievements

- Participated in the training workshop for developing projects on Sustainable Development Mechanisms in Madagascar;
- Participated in preparing the second National Communication in inventorying emissions of greenhouse gases from the industry sector;
- Action plan on reducing Dioxins and Furans established (to be submitted to Secretariat);
- Contributed to the development of the national profile for chemical management;

I.TRANSPORT SECTOR

I.1. PER ECOSYSTEM APPROACH

The sector of rail-bound transport, ports, and maritime and river transport contributes to upholding continental water and marine ecosystems by developing EISs prior to rehabilitation works (e.g.: rehabilitation of the Port of Antsiranana).

I.2. ACHIEVEMENTS

Achievements of the transport sector are described in Table 32. However, Civil Aviation has specific features:

Control of bird and animal strike hazards in airfields: Procedures for controlling bird and animal strike hazards have been agreed upon by the concerned bodies to avoid reduction or suppression of certain rare species. Indeed, ADEMA (Airport of Madagascar) is currently looking for ornithological specialists to undertake studies to improve these control procedures.

Mitigation of noise annoyances in airports: As member of ICAO and IATA (International Air Transport Association), Madagascar pays attention to the noise generated by the engines and reactors of aircrafts used at Madagascar airfields. Periodic controls are conducted for this purpose.

Table 32: Projected Actions and Achievements of the Environmental unit of the Civil Aviation, Road Transport, and Rail-bound Transport sectors

	Projected actions	Achievements
Civil aviation	-Develop texts to enforce Act N°2004 – 027, -Evaluate aircraft noise levels , -Research for funds and specialists in ornithological studies, -Implement protocols and policies to ensure environmental compliance on airfields, and -Environmental and social impact studies for the expansion of the international airport of Ivato / Antananarivo and the Antsirabe airport.	-Instruction N°01 - DG/DANA of 02.23.2007 defining the roles and responsibilities of all bodies in charge of preventing bird strike hazards in aerodromes developed, -Shooting, poisoning, and startling methods performed with airport services consultation, -Periodic controls of aircraft engines and reactors noise conducted, - Airport waste management implemented with the collaboration of local authorities and nearby riparian

		population collaboration, -Airport emergency plan (Propagation of dangerous goods) implemented, -Environmental component integrated into airport projects, -Terms of Reference of environmental and social impact studies to ensure environmental compliance in the expansion of the Airport of Ivato / Antananarivo established, -Treatments of wastes and wastewaters in airports conducted, -Birds frequenting aerodromes identified to avoid suppression of rare species, and -Erosion in and around airport construction sites mitigated,
Road transport	- Further develop synergy between organizations in relation with the motor vehicles control center (Customs, Criminal squad, Land transportation agency, etc.), - Computerize all control centers in Madagascar, and - Progressively equip relevant centers with apparatuses allowing to measure motor exhaust (combined gas analyzer/opacimeter kit).	-Consultation platform established, periodic meetings hold, -Control centers equipped with a computer, vehicle control line, opacimeter/gas analyzer -Decrease in the proportion of vehicles deemed unfit following the systematic control motor exhaust at the Center (Annex Nanisana) in Antananarivo
Rail-bound transport	-Make the riparian population responsible/ Raise awareness among the riparian population by setting up village associations to facilitate their participation in environmental conservation (i.e., control of bushfires or slash and burn fires, illegal logging, charcoal production within railway site areas), -Prohibit timber and charcoal transportation, -Conduct reforestation in target sites, -Stabilize black spots by combining civil engineering techniques with reforestation, -Implement EIS prior to large-scale projects, -Transportation governed in compliance with environmental specifications -Prohibit the use of wooden crossbeams -Prohibit the transportation of wild plants and animals and the use of herbicides -Clear out canals -Set up de-oiler -Prohibit discharge of caustic substances (acid/base) in sewers	- Report/Census of offences and law-suits of offenders conducted, -No bushfire recorded in the Northern network this year, -Income improved for Village Associations, which alleviates poverty, a major cause of the unsustainable use of biodiversity, - transportation of timber or charcoal from 2006 to 2009 reduced in number, -In 2008, EIS of the MLA line to set up projects implemented to address the degradation of catchment areas (both mechanical and biological techniques), -Reduction of the use of wood: e.g.: replacing wooden crossbeams with metal or concrete ones – metal used over a length of 46,571 meters and reinforced concrete over 170,879 meters, - transportation of wild plants or animals from 2006 to 2009 reduced, - Clearing rivers of sands, -Compliance with standards relating to the water quality prior to discharge, and -Absence of eutrophication within canals.

Table 33: Projected actions and achievements of the environmental unit of the Port and Maritime and River Transport sector

Sectors	Projected actions	Achievements
Port, Maritime and river transport	-Build "collection facilities" in the ports of Toamasina, Antsiranana, and Mahajanga to collect and treat port wastes from ships, especially bilge water, tank water containing hydrocarbons, waste oils, and waste waters, as well as refuse, -Considerate marine environmental protection for different port construction projects depending on investments from operators, -Rehabilitate urgently the Pangalanes Canal, -Monitor the completion status of the	-Suspension of bids, given the current situation in Madagascar, -A Regional Workshop by OMI and the Indian Ocean Commission (IOC) as part of the "Project of maritime route development and prevent marine and coastal pollution in Western Indian Ocean" performed, -Huge progress as compared to the situation in 2005 with regard to sanitation measures, -Environmental prescriptions, visit of the Canal with an ONE Agent, training of the participating staff including Fokontany heads on standards for work

	rehabilitation of the Container Terminal in the Port of Toamasina (TAC) by Madagascar International Container Terminal Service Ltd (MICTSL) -Contribute to the ratification of important conventions, -Draft text on the prevention of pollution by small boats, -Develop a draft of New Malagasy Maritime Law (NCMM), and -Develop a guide to "mark out" and "frame" the development of the future mineral port of Antserake in consultation with the National Office of Environment.	regarding aquatic plant removal, and sand clearing -The New Malagasy Maritime Law and guideline developed, and -Important conventions ratified: International Convention on Oil Pollution Preparedness, Response, and Cooperation (OPRC) in 1990, Hazardous Noxious Substances (HNS) Convention in 2000; International Convention on Civil Liability for Oil Pollution (CLC) in 1992, International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage in 1992, and MARPOL Convention 73/78 (International Convention for the Prevention of Pollution from Ships)

J. INTEGRATION OF THE ENVIRONMENTAL DIMENSION TO CROSS-CUTTING FIELDS

The table below describes the achievements of the Environmental Unit in cross-cutting fields.

Table 34: Achievements of the Environmental Unit in cross-cutting fields

	Projected actions	Achievements
Ministry of Interior (MININTER)	-Ensure enforcement of legislative and regulatory texts relating to environmental management, -Ensure dissemination of intra-ministerial environmental information to other authorities and partners involved in environmental management, and - Conduct MININTER's annual reforestation.	- Four Districts (Moramanga, Ivohibe, Manajary, and Maintirano) informed about regulatory provisions in to enforce the required measures for solving environmental problems - Grouping session of District Heads at the Ministry of Interior's premises to periodically assess fires in their respective districts and report on them to the Central level.
Ministry of Justice	-Restore rule of law regarding the environment, - Launch forest RRIs at the level of 22 regions, -Contribute to environmental protection, and - Inform and raise awareness on the "Green Action".	- Maritime Code reformed to retrofit with the International Convention on the law of the Sea and on sea actions ratified by Madagascar - Setting up of RRIs to process files relating to forest legislation - Coordination between the procedure and training of agents in charge of enforcing the legislation conducted in Ambositra, Fianarantsoa, Manakara, Toliara, Ambatondrazaka, Taolagnaro, Antsohihy, Ambanja, and Analanjirofo -The African Network of Environmental Information implemented, and -Synergy of Focal Points actions related to environmental International Conventions.
Ministry of Foreign Affairs (MAE)	-Ratify the International Agreement on tropical wood 2006 -Present the Bill authorizing the adoption of the Bill relating to the Madagascar's Biosafety regime to the Parliament, -Contribute to the implementation of environmental policy, and -Contribute to the repatriation of Malagasy protected species seized at other International airports under CITES.	-Contributed to the repatriation of species seized at International airports under the CITES Convention - Madagascar's candidature to host the AETFAT congress (Botanists' Congress) in 2010 accepted (166 votes against 70 during the 18th Congress in March 2007 in Yaoundé), -Participated in international meetings: various meetings held with the Consulate General of Thailand in Madagascar and the concerned sectors: sent the certificate confirming animal endemism to the Honorary Consulate of Madagascar in Bangkok, and - Memorandum of Understanding of Cooperation between Madagascar and Thailand for the protection of endangered species established and signed.
Ministry of National Defense (MDN)	-Contribute to the establishment of legislative and regulatory texts related to environmental management, - Align sectoral procedures to be consistent with the environmental policies (underway) - Reinforce bushfire prevention systems -Draw up a memorandum of understanding for reforestation actions (MDN-MINENVEF, Ministry of Environment, Water, and Forests). -Collaborate with MINENVEF to monitor and control environmental and forest monitoring actions -Control marine pollution and illegal use -Disseminate intra-ministerial environmental information - Conduct a reforestation campaign	-Specific actions taken by the police force, -Making 04 non-commissioned officers and 06 Gendarmes available to the MINENVEF to support its mission, -Reforestation: 3,000 seedlings planted by MDN/PC, 402,000 seedlings by COMGN and EMGAM, -Mission of the army-gendarmerie unit performed to eradicate bushfires within the national territory, and -Seizing of products (wood, precious stones, etc.) deriving from illegal exploitation seized.

Ministry with the presidency in charge of decentralization and land development	-Ensure implementation of regulatory texts, -Participate in the National Policy relating to the environment, -Reinforce our 2008 awareness-raising campaign relating to the environment -Inform people on the environment's importance and the existence of texts relating to the environment, and -Ensure land tenure security in collaboration with the Land Project of Millenium Challenge Account (MCA).	- Local Land Occupation Plans (PLOF) in the regions of Vakinankaratra, Amoron'i Mania, Menabe, Atsinanana, Boeny, and DIANA developed, -Protected Areas cartographic data overlapped with PLOFs to avoid conflicts, with regards to land tenure security at the zones' periphery and/or within the zones. Delineation of the areas was created with collaboration from MPAS and concerned promoters through various working sessions. Each hard copy of PLOFs will feature the general layout of the concerned commune, including the boundaries and name of the protected areas located within it.

In spite of these achievements towards the integration of environmental issues into other sectoral ministries, efforts still need to be provided to improve environmental communication and find funding for each sector's environmental activities.

CASE STUDY ON INTER-SECTORALITY: the environmental aspect of the QMM project (Razanatsimba M. F., Rabearison H., Ralaikoto H. et and Randriafeno R.)

ISSUES

The presence of QMM and its team of experts in the region of Fort-Dauphin for more than sixty years will allow for gaining in-depth knowledge on various environmental aspects. The company's initiatives and its support to those of the region allowed for adopting a more sustainable development strategy for the sector's natural resources.

The projected mining area will first be cleared and scraped off as the dredger proceeds. 2010 out of 2370ha, a total surface of Mandena mining area, will be full transformed. The difference of 230ha corresponds to areas of coastal forest and marshes that have been set aside for conservation purposes. This conservation zone, which has already been integrated to the project's mining planning (Chapter 4), amounts to 10% of the mining area's surface area and 8% of the ilmenite volume. A surface area of 20ha has also been set aside to serve as a protective strip on the edges of streams and lakes.

Open Habitat

Open habitat dominated by *Philippia* and the other types located in the mining zone are extremely degraded land environments. They are not home to any rare or vulnerable plant or fauna species. Biophysical studies conducted in such habitats suggest that the clearing of these areas will not raise any environmental issues. Therefore, the relating impact on the flora and fauna of open habitats is qualified as minor.

Marshes

The marshes located in the mining zone are subject to pressures and degradation, which will affect the biota living there on the long term. At the time of the mining or in 10 or 15 years, a certain proportion of the marsh surface areas, which are currently productive, could stop being so if the current trend is upheld. Still, unlike the littoral forest which is quickly and irreversibly degrading because of pressures and regular fires, marshes are less affected and have a certain capacity of regeneration (*mahampy* among others). This capacity enables the ecosystem to survive successive fires. However, such tolerance is limited and today some marshes that once were productive have become unproductive.

At present, it is difficult to determine the state of the marshes at the time of the mining and across a period of 25 years. Nevertheless, it is predicted that five to 10 years after the mining's set up, marshes will still be productive.

The mining will also alter the fauna community living in the marshes. While some species could be move and adapt to peripheral habitats, others will not. In terms of biological diversity, marshes doesn't contain to any rare or endemic species: species living there are widespread in Madagascar and elsewhere.

Therefore, these areas' flora and fauna do not raise any particular conservation and protection concerns. As such, the project's impact on the marshes' flora and fauna is qualified as average.

Littoral forest

For numerous years, the littoral forest located in the mining area has been heavily altered by the increase of anthropogenic pressure in the region and the effects of a long process of deforestation and degradation. Different threats to littoral forest have impact on the reduction of almost the whole forest areas, increasingly fragmented and degraded units as the only vestiges of the original forest. Consequently, the flora and fauna diversity has been reduced and there has been significant disturbance of the forest communities' structure. Moreover, the forest's increasingly marked fragmentation and advanced stage of degradation caused major intrinsic changes, making the irreversible loss of ecosystem biodiversity even more marked. The forest landscape of Mandena nowadays has a significantly fragmented profile with most residual forest parcels isolated one from another.

From 1950 to 2000, about 74% of the forest areas of Mandena had been cleared (60% of the coastal area as a whole), i.e. an average rate of 27ha/year. In 2000, an updated inventory of the mining area's residual forests revealed that there was no intact forest parcel left. It was described that nearly 73% of the forest areas as extremely degraded (stages 4 and 5) and the remaining (27%) as moderately degraded. Deforestation will continue, with or without the mining project, and if the current trend in Mandena of 27ha forest lost per year remains constant, the forest may be totally cleared as soon as 2020.

Assuming that the different sources of pressure on the littoral forest and the intensity of collection remain the same over the next years, it is expected that most of the residual forest in 2001 (203ha) will have been cleared when the dredger will reach the first forest units and even if there still remains a few hectares of forest at that time, these will be highly degraded. If deforestation and degradation increased with the population growth, the surface area of the residual forest will shrink even more rapidly. It follows that it is difficult to accurately assess the surface area of residual forests in Mandena when mining will start, but historical trends suggest that the residual forest will be gone before the dredger. Inventories have shown that the Mandena forest is a home to 369 flora taxa. The last studies on flora and current knowledge of botany allowed for drawing up a list of 22 species endemic in Mandena forest. These species' status was described in Section 3.4.3. All of them were recently found and inventoried within the conservation area proposed in Mandena or out of the mining area, as well as elsewhere on the coastal area.

Fresh-water and estuary habitats

The physical and chemical properties of the aquatic ecosystems located upstream of the mine dump area will be altered. This alteration will cause changes of composition in aquatic floristic communities. Upstream of the dumping, water will gradually become less salty and some fauna and plant species will progressively be changed. Nonetheless, none of the riparian plant species identified in the aquatic ecosystems upstream of the dumping as part of the present study are rare, endangered, vulnerable, or endemic.

The studies conducted in May and October 2000 (CSSA, 2001), upstream of the projected dump, show that mangroves are colonizing the banks of the lake of Ambavarano and river of Mandromodromota. Existing individuals form a thin fringe of trees along the banks and do not actually constitute mangroves. Indeed, this estuary is steep-sided and does not offer conditions favorable to the development of this type of ecosystem.

The presence of the dumping will modify the seasonal fluctuation pattern in the Ambavarano Lake and the Mandromodromota River, when sand covers the mouth of the Anony River and will also affect the daily fluctuation pattern when the mouth is open. In the long term, the absence of daily fluctuations caused by the tide upstream of the mine dump area may affect the mangroves (characterized by *Bruguiera gymnorhiza* and *Lumnitzera racemosa*). Although daily fluctuations are

non-existent two to three months per year – i.e. when a sandbar settles in the mouth of the river of Anony – they remain one of the ecological conditions intrinsic to the mangroves' growth.

Even if the species seem to tolerate the absence of daily fluctuations, it can be forecasted that the new conditions that will prevail following the mine dump construction will not be favorable to the inventoried mangroves. It follows that, in the long term, these trees will be replaced by freshwater species and freshwater mangroves (*Barringtonia racemosa*). Besides, mangroves downstream of the dump area will not be affected, given that the waters' physical and chemical properties and level fluctuations resulting from tides will be preserved. Mangroves are euryhaline species: they tolerate variations of the salt content in water but they do not need them to grow.

Long-term replacement of mangroves and other brackish water plants upstream of the dump area could impact on the banks' stability. Indeed, the mangrove fringe combining *Bruguiera gymnorhiza* and *Lumnitzera racemosa* plays a relatively important role in stabilizing the banks with respect to the distances covered and not the surface area covered.

An impact of average extent is therefore expected with respect to the modification of the vegetation structure on the edges of the lakes of Besaroy and Ambavarano, as well as along the first kilometers of the river of Mandromodromotra. Planting freshwater mangroves, *Typha angustifolia*, and cyperacea in areas at risk of erosion will mitigate the impacts on the water quality modification (brackish water and fresh water) on the plant cover in the parts affected. The residual impact forecasted is therefore of minor importance.

MITIGATION MEASURES

As regards rehabilitation, reforestation of the various mining areas in Fort-Dauphin will be conducted while they are exploited. Following mining activities, rehabilitation will result in the establishment of some 6,000ha of forest that would never have existed without the project. A few years after the end of their exploitation, each of the three mining areas (Mandena, Petriky, and Sainte-Luce) will be fully reforested. The villagers' and authorities' commitment to implementing and managing rehabilitation activities throughout exploitation will contribute to effective management transfer, long before the closing of the various mining areas. Fast growing species will be planted to ensure the villagers' wood supply. Also, setting aside zones of littoral forests from the mining areas and ecologically restoring these areas will support conservation efforts and contribute to better protection of the unique biological diversity of the coastal forest.

As part of the region's sustainable development, the forest resources exploitation strategy will provide for the creation of reforestation zones, which will offer opportunities during and after the company's mining activities. In the event the Government decides to set up the conservation zones proposed in the various mining sectors and the efforts of QMM, authorities, villagers, NGOs, etc. prove successful, these areas will allow for protecting unique ecosystems and constituting a biodiversity legacy not just for the region, but for the island of Madagascar as a whole. Like rehabilitation, the creation and management of conservation zones will require the participation of villagers and authorities, who will fully ensure such management before the end of the mining.

As part of the region's sustainable development, conservation zones will form an integral part of the ecotourism strategy and will offer opportunities during mining and after the company's departure.

Open Habitats

Valorization measures enforced will include reforestation of open areas with species valorized by the surrounding population. Experiments in recent years have shown that the selected plants will be able to adjust to the site's difficult conditions after mining.

Reforestation of the sites with fast growing species that villagers can use will allow for reducing pressure on remaining natural forests and restored forests.

The surface area that will be reforested with fast growing species (approximately 1,590ha) is estimated at nearly 75% of the mining area. The mitigation measures enforcement aimed at rehabilitating these environments so that they will support more economically valuable species than previously will add value to the sector. As such, a positive residual impact, estimated to be of average importance, is expected.

Marshes

Proposed mitigation measures provide marshy environments restoration, mainly marshes in *Mahamy,* which are actively used by women in the area. Restoration of the marshes is planned for approximately 15% of the mining area (318ha), i.e. the equivalent of the current surface area.

The main factor limiting the surface area of marshy environments restoration is the of organic soil availability. Setting aside 70has of marshy forests from mining activities will also enable conserver important biodiversity in this region. The characteristics of the marshy environment in the sector of Mandena will therefore be conserved on the long term.

The measures enforced will also allow for valorizing the resources used by the population. A minor residual impact is identified.

Littoral forest

The actions, taken by QMM to conserve 160has of forest (units M15 and M16), are aimed at upholding the flora and fauna species representative of the littoral forest of Mandena as a whole.

Although the mining area is not home to any endemic fauna species, some species are extremely rare in Mandena, such as *Eulemur fulvus collaris*, whose last population in Mandena was recently relocated in the proposed conservation zone to promote its survival (section 3.4.4).

In short, in a context of progressive deforestation, the impact of forest's destruction (and consequently of the flora and fauna living there) for mining purposes is considered as limited.

Impact on the littoral forest's flora and fauna is qualified as minor. The intensity of the changes caused by the mine and its exploitation must be highlights. If the forest of Mandena had been free of any pressure, the impact associated with the destruction of 203ha of forest would be major.

Proposed mitigation measures include various actions, such as the conservation of 160ha of littoral forest and after mining, forest restoration will be approximately 10% of Mandena surface area (about 212ha). Proposed mitigation measures will promote the preservation of the flora and fauna components characterizing the coastal forest in Mandena. Other measures include creating a conservation zone, planting species that can become alternative solutions to wood, restoring the coastal forest, conserving seeds, and relocating some animal populations. Consequently, a positive residual impact of minor importance is expected.

REHABILITATION MEASURES

The whole surface area (2,120ha) of the sector to be exploited will be rehabilitated. Two types of rehabilitation have been tested in the last years: ecosystem restoration (to be implemented on 10% of the surface, or 212ha) and planting fast growing species (planned for 75% or 1590ha of the site). The restoration of forest ecosystems will require quality topsoil with high organic content. Current estimations indicate that there will not be enough of this soil to restore more than 10% of the mining sector. Lastly, 15% of the marshes' surface area will be rehabilitated (318ha).

CONSERVATION MEASURES

To ensure protection of the forest's last vestiges and their plant and animal species, the promoter proposes to set a forest area of 160ha aside from the mining area. Conservation of this unique natural environment is essential to uphold the biological diversity and genetic variability of this type of forest. This measure for conserving a vestige of littoral forest in Mandena is also vital to villagers who may find important resources in this forest, in terms of common medicinal plants, rights to use forest resource, income linked to tourism, etc. The conservation zone will be a site for collecting native seeds for restoration purposes, relocation of certain animal species, protecting one of the last fragments in good state in Mandena, conducting *in situ* conservation and propagation of vulnerable and useful flora species of Mandena, and performing permanent research on the littoral forest and its biodiversity.

A management plan including a conservation strategy is presented in Chapter 7. The success of the conservation zone project depends on the collaboration among stakeholders, i.e. QMM, villagers, the Ministry of Water and Forests, and Regional Development Committee (CRD).

During the project implementation, numerous efforts were provided to protect the sectors. The method used by QMM to implement a global biodiversity conservation and renewable natural resources sustainable management strategy effectively focused on the creation of conservation zones. In a context of progressive deforestation and in consideration of the respective specificity of the forests of Sainte-Luce and Petriky, the promoter additionally proposes to create conservation zones in these two sectors. Figure 5.13 shows a map of the zones targeted by QMM for conservation and saved from the mining area.

It was therefore agreed during the project's planning phase, to set a zone aside from the mining sector of Mandena and use it to maintain the characteristics relating to the sector's biodiversity. As such, the conservation of 230ha mainly including littoral forests (70%), considered as in a state of moderate degradation and marshy forests (30%) will allow for safeguarding the distinctive characteristics of the zone's ecosystems. This measure, which pertains to forest units M15 and M16 will allow for conserving the flora and fauna species representative of Mandena littoral forest as a whole.

Proposed conservation zones in Sainte-Luce and Petriky (490ha) are also aimed at conserving endemic, rare, and threatened flora and fauna species.

The conservation zone of Mandena is in the process of being established, with collaboration from local partners (local authorities, villagers, and CRD). The zones of Sainte-Luce and Petriky will then be created. The pilot experience conducted in Mandena will help orient the strategy for the two other sites.

Other conservation measures, put on trial in the past years will be maintained. They pertain to:

- *In situ* and *ex situ* regeneration and propagation of vulnerable and endangered flora species;
- Long-term conservation of native species' seeds;
- Relocation of certain fauna species;
- Captive breeding of some rare populations for reintroduction purposes.

CHAPTER IV

PROGRESS TOWARDS THE GLOBAL BIODIVERSITY 2010 TARGET AND THE IMPLEMENTATION OF THE CONVENTION STRATEGIC PLAN

A- ASSESSING PROGRESS TOWARD THE GLOBAL BIODIVERSITY 2010 TARGET

Key achievements regarding the 2010 targets are summarized in the following table:

Table 35: Assessing Progress toward the Global 2010 Targets

2010 target (global level)	National Targets	Progress made
1.1 At least 10% of each of the world's ecological regions effectively protected	At least 10% of the territory (6 million ha) has protected status,	- 4 751 895 ha of protected areas created under different protection statuses, approximately 8% of the total area of Madagascar
	with significant representation of different ecosystems	- More than 90% of ecosystem types are significantly represented in the system of protected areas, particularly marine and wetland ecosystems (cf. Chap 2)
1.2 Areas of particular importance to biodiversity protected	Important biodiversity areas protected	New protected areas (3 million ha) targeted to contain species with restricted distribution, to maintain special ecological functions (e.g., corridors) and to ensure the biological cycle of some species
2.1. Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups	Implement in-situ and ex-situ conservation action of rare and threatened flora and fauna species	-Conservation strategies and plans of threatened species implemented (amphibians, crocodiles, tortoise, votsitse, Prunus Africana, freshwater birds, migratory birds, and lemurs), -Turtle Excluding Device (TED) AND Bycatch Reducing Device (BRD) for shrimp trawl measures regulated, -Crocodiles multiplication center implemented, -Two marine resources exploited and their development plans updated regularly, - Fish breeding programs and activities on different lakes implemented, and - Coral reef transplantation within two different localities implemented.
2.2 Status of threatened species improved	Improve knowledge on threatened species	- CBD Information exchange centre maintained and updated, - Conservation status of some taxonomic groups for IUCN red list updated : 15 out of 371 reptiles species, 244 species of amphibians, 283 species of birds, 154 species of fish and 90 out of 99 species of lemurs (see Chap 1) - *In situ* and *ex situ* conservation of threatened species
3.1 Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained.	Preserve agricultural and forest genetic resources (in the past, cattle was also concerned)	- Some genetic heritage conserved, - Over 1000 accessions of related wild species maintained by FOFIFA - About 1000 native plant species preserved as seeds at the "Silo National pour les Graines Forestières", and - Breeding feasibility studies carried out on some taxonomic groups: endemic freshwater fish, holothurians, mussels, tortoises, and freshwater turtles.
4.1 Biodiversity-based products derived from sources that are sustainably managed, and Production areas managed consistent with the conservation of biodiversity.	Manage sectors in a sustainable manner	- Habitat of aromatic plants for trade identified and ecologically inventoried, - Adoption of the 6 protected areas IUCN categories allowing opening their management to private sector and to local communities, in the Amendment of the Protected Areas Regulation awaiting legalization, - Addis Ababa's principle of sustainable use of resources in new protected areas implemented, - Extraction and exportation of essential oils subject to authorization, and - Fishery master plan for sustainable use and environmental protection implemented.

2010 targets (global level)	National targets	Progress made
4.2 Unsustainable consumption, of biological resources, or those impacts upon biodiversity, reduced	Address illegal exploitation of and excessive collect of resources	- Forest zoning and logging controlled, - Collection regulation of forest products for processing or for exportation implemented, - Consideration of threatened species in the review of environmental impact assessments, - Fishing equipment controlled,
4.3 No wild flora or fauna species threatened by international trade	Regulate exportation of threatened flora and fauna species	- Madagascar's membership to CITES, - Species trade regulation enforced: decree N° 2006—097 set the procedures for enforcing the wild flora and fauna international trade law (defining the competence of the management institution and the authorities and the nature of their relationship) and decree 2006—98 for the publication of reviewed appendix of CITES, and - Measure of export bans for Species listed in Appendix I of CITES implemented, and export quotas for the species listed in Appendix II established.
5.1 Rate of loss and degradation of natural habitats decreased	Protect land, marine ecosystems, and sea and coastal areas	- Tripling the surface area of protected areas within Madagascar, - Forest zoning and logging controlled, - Forest management transfers with limited authorized collection implemented, - Ramsar convention for protection of wetlands and establishment of Ramsar sites ratified and signed: eight Ramsar sites established, - Marine protected areas created, - Environmental dashboard for communicating environmental information established, and - Include natural habitats in the official definition of sensitive areas where environmental impact assessments and preservation measures are mandatory
6.1 Pathways for major potential alien invasive species controlled	Regulate introduction of exotic species	- Adoption of seeds regulation and - Introduced quarantine for exotic species.
6.2 Management plans in place for major alien species that threaten ecosystems, habitats or species.	Control invasive species in protected areas	- Control of invasive species (ex: *Opuntia stricta in the Androy region*) implemented
7.1 Maintain and enhance resilience of the components of biodiversity to adapt to climate change	Facilitate species adaptation to climate change, - Find synergy between CBD and CCC for national implementation	- Forest corridors protected, - REDD-related tests carried out.
7.2 Reduce pollution and its impact on biodiversity	Reduce impact of projects and investments on environment and biodiversity	- Industrial pollution laws adopted, - Precaution principle to investments and the decree introducing environmental impact assessments (MECIE) implemented, - Environmental prescriptions for regional development programs established, - Environmental unit within different sectors developed, and - Marine oil Pollution Event Control Organization (OLEP _ PECO) established.

2010 targets (global level)	National targets	Progress made
8.1 Capacity of ecosystems to deliver goods and services maintained	Preserve the quality and importance of natural resources to allow sustainable economic growth and a better standard of living;	- Assessment of environmental services provided by ecosystems and protected areas conducted (e.g., hydrological services, leisure, cultural value), - Adoption of the new code for protected areas facilitating the integration of target areas into the protection status, - Slash and burn for agriculture controlled (constant decrease of burned surfaces), - Forest restoration and trees plantation programs implemented, - Maintaining forest cover within the REDD program. - Natural resources management transferred to local communities
8.2 Biological resources that support sustainable livelihoods, local food security and health care, especially of poor people maintained	Maintain agricultural biological diversity and related wild plants.	- Crop races improved and maintained by the FOFIFA (Rural Development National Research Center), and FIFAMANOR (Norway-Madagascar Cooperation for Farming and Agriculture Development), - Organic agriculture of local ecotypes: currently, over 50 varieties of sweet potatoes were identified in the southern region of Madagascar alone, nearly 60 local varieties of maize, and over 1500 indigenous races of rice, - Accessions of local ecotypes represented in the FOFIFA collection are: 35% for rice, 13% for maize, 32% for vigna, 60% for voandzou. - Integration of the use of medicines products from plants origin into public health (see Chap3).
9.1 Protect traditional knowledge, innovations and practices.	Enhance the value of traditional knowledge. Design a regulation with enforcement related to Access and Sharing the Advantages (ASA) or "Acces et Partage des Avantages" (APA).	- Regional stakeholder trained by the German-Dutch initiative on ASA for Africa, - Participation in establishing an international APA scheme, and -A national regulation text on protection of access rights to genetic resources under development.
9.2 Protect the rights of indigenous and local communities over their traditional knowledge, innovations and practices, including their rights to benefit sharing	The access and sharing strategy is already designed.	- Local community participation in the management of protected areas within the framework of joint-management, inclusive ecological monitoring, biological research, and profit sharing (case of the ICBG project. see Chap.2) promoted, - Preservation of traditional rights through resource management transfer in progress, - Strategy and Bill relating on access and sharing of advantages established, and - Implementation of safeguard plan and environmental and social management plans made mandatory in establishing new protected areas.

2010 targets (global level)	National targets	Progress made
10.1 All transfers of genetic resources are in line with the Convention on Biological Diversity, the International Treaty on Plant Genetic Resources for Food and Agriculture and other applicable agreements.	Implement the convention on genetic resources transfer	- Research regulation implemented, - Design preliminary draft of a law regulating the genetic resources transfers in progress.
10.2 Benefits arising from the commercial and other uses of genetic resources shared with the countries providing such resources	Given that Madagascar is a genetic resource provider country, the current legal framework provides a sharing system based on the use of the resources by user countries.	Agricultural research improved by international funders: FOFIFA joined ASARECA and its different thematic networks. This initiative which has been running for two to three years encouraged some sectors like seedy vegetables (ECABREN), cassava (EARRNET), and maize (ECAMAW), and enrichment of collection through plant material exchange. However, it's noticed that in 2005 the number of research decreased when compared to ten years ago.

B. ASSESSING PROGRESS TOWARD THE IMPLEMENTATION OF THE CONVENTION'S STRATEGIC PLAN

The implementation of the National Plan for the Environment and the National Strategy for Sustainable Management of Biodiversity is a key mechanism for the implementation of Convention's Strategy plan.

Table 36: Assessing Progress toward the Implementation of the Convention's Strategic Plan.

Goal 1 : The Convention is fulfilling its leadership role in international biodiversity issues			
Strategic objectives	National contribution		Encountered barriers
	Objectives	Achievements	
1.1 The Convention is setting the global biodiversity agenda.	The country adopts the global program for biological diversity.	Adoption of the 2010 target to put under conservation status 10% of the territory with a significant representation of all ecosystems, by tripling the surface of protected areas	
1.2 The Convention is promoting cooperation between all relevant international instruments and processes to enhance policy coherence	The country facilitates synergy among all ratified international conventions to improve national policies coherence.	- Some international conventions related to biodiversity ratified: CITES, RAMSAR, climate change, migratory birds, regional marine and coastal environments (Nairobi) - Coordination board for international conventions implementation in place within the Ministry of Environment.	
1.3 Other international processes are actively supporting implementation of the Convention, in a manner consistent with their respective frameworks.	Public aid for development actively supports the implementation of the Convention, following donors' frameworks.	-The NEAP is supported by multiple donors and international cooperation agencies, -Madagascar's agreement with international initiatives on Biodiversity such as the Like Minded Country in Access and Benefits Sharing (LMMC), -The international treaty on phytogenetic resources for food and agriculture implemented, and - Synergy among CDB, CCNUCC, and CLD developed.	
1.4 The Cartagena protocol on Biosafety is widely implemented.	The country is implemented the Cartagena protocol on Biosafety.	- The biosecurity national action plan established, -A Biosecurity Clearing House and a Biodiversity Clearing House Mechanism implemented	
1.5 Biodiversity concerns are being integrated into relevant sectoral or cross-sectoral plans, programmes and policies at the regional and global levels.	The country insures that biological diversity issues are integrated in relevant sector or inter-sector plans, programs and policies at the regional Level.	Biodiversity issues are integrated in COI, SADC, and African Union's action plans	
1.6 Parties are collaborating at the regional and subregional levels to implement the Convention.	The country collaborates on the regional and sub-regional levels to implement the Convention.	- Western Indian Ocean projects for marine and coastal environment (RAMP, PROGECO) implemented, - Global marine resource assessment (ASCLME) conducted, and - Participation into the African initiative for Access and Benefits sharing (ABS)	

Goal 2: Parties have improved their financial, human, scientific, technical and technological capacity to implement the Convention.			
Strategic objectives	National contribution		Encountered barriers
	Objectives	Achievements	
2.1 All Parties have adequate capacity for implementation of priority actions in national biodiversity strategy and action plans.	The country has suitable capacities to implement priority activities provided in national biological diversity strategy and action plans.	- Academic training programs in biology and earth sciences are established in universities, - Specialized programs for biodiversity, protected areas management, impact assessments and information management are in place, and - A network of sustainable biodiversity management trainers is in place (REPC) and supported by international NGO's.	The increase in the surface area of protected areas and the climate change issue induced new needs
2.2 Developing country Parties, in particular the least developed and the small island developing States amongst them, and other Parties with economies in transition, have sufficient resources available to implement the three objectives of the Convention.	The country has adequate resources to implement the three targets of the Convention.	- The national environmental program supported by bilateral and multilateral donors and international conservation non-governmental organizations, - A Trust fund for biodiversity and protected areas in place.	The implementation of the Convention is mainly supported by international donors. The national funding mechanisms are insufficient
2.3 Developing country Parties, in particular the least developed and the small island developing States amongst them, and other Parties with economies in transition, have increased resources and technology transfer available to implement the Cartagena Protocol on Biosafety.	The country increased its resources and the technology transfer available for the implementation of the Cartagena protocol on Biosafety.	The funding of the national Plan for the implementation of the Convention obtained.	The funding is not currently available
2.4 All Parties have adequate capacity to implement the Cartagena protocol on Biosafety.	The country has adequate capacities to implement the Cartagena protocol on Biosafety.	Staff from different entities are trained on biosecurity clearing house mechanism: the Ministry of Environment and Forests, the National Environmental Office, Madagascar the National Parks, Universities, the Ministry of Agriculture, the National Silo of Forest Seeds, and the Ministry of Health	
2.5 Technical and scientific cooperation is making a significant contribution to capacity building.	Technical and scientific cooperation contributes effectively to capacity building at the national level.	- Environmental program implemented with the collaboration of international technical cooperation organizations (USAID, GTZ) and specialized international NGO's (WWF, WCS, Conservation International, MBG), and - Scientific cooperation in research between national Universities and foreign Institutions established.	

Goal 3: National biodiversity strategies and action plans and the integration of biodiversity concerns into relevant sectors serve as an effective framework for the implementation of the objectives of the Convention.			
Strategic objectives	National contribution		Encountered barriers
	Objectives	Achievements	
3.1 Every Party has effective national strategies, plans and programmes in place to provide a national framework for implementing the three objectives of the Convention and to set clear national priorities.	The country implements appropriate national strategies, plans and programs to provide a national framework for the implementation of the three targets of the Convention and to set clear national priorities.	A national strategy for the biodiversity sustainable management through the environmental action plan (NEAP) and specific plan for threatened species conservation implemented.	
3.2 Every Party to the Cartagena Protocol on Biosafety has a regulatory framework in place and functioning to implement the Protocol.	The country has a regulation and operational framework for the implementation the Cartagena Protocol on Biosafety.	- A national policy on biosecurity was adopted and - A bill on biosecurity written.	
3.3 Biodiversity concerns are being integrated into relevant national sectoral and cross-sectoral plans, programmes and policies.	Environmental Mainstreaming is conducted.	- Strategic environmental assessment of the main national development programs, including agriculture, roads, transport, infrastructures, etc.. - Protected areas and forest zoning are integrated in the national land management scheme, and - Environmental prescriptions of regional development plans established.	
3.4 The priorities in national biodiversity strategies and action plans are being actively implemented, as a means to achieve national implementation of the Convention, and as a significant contribution towards the global biodiversity agenda.	Priorities activities of the national strategies on biological diversity effectively implemented.	The PNAE funding allocated to green environment.	

Goal 4: There is a better understanding of the importance of biodiversity and of the Convention, and this has led to broader engagement across society in implementation.			
Strategic objectives	National contribution		Encountered barriers
	Objectives	Achievements	
4.1 All Parties are implementing a communication, education, and public awareness strategy and promoting public participation in support of the Convention.	The country is implementing a public communication, education and public awareness strategies and promotes public involvement to environment program.	a. A national policy related to environmental education implemented: - An awareness campaign related to environmental conservation and bushfire reduction conducted, - Consideration of environment in scholar programs; - Regular environment broadcasts on national Television and radio. - Various communication kits focused on environment and biodiversity developed (Vintsy, Kit Mad'ERE)	
4.2 All Parties are implementing a communication, education, and public awareness strategy and promoting public participation in support of the Convention.	Conduct information and public awareness on the Cartagena Protocol on Biosafety.	- Maintenance of the Biosecurity Clearing House	
4.3 Indigenous and local communities are effectively involved in implementation and in the processes of the Convention, at national, regional and international levels	Involve local and native communities into biodiversity sustainable management program.	- Local communities involved in protected areas creation and management, -Traditional medicine improved and organization of traditional healers established, - Community participated in ecological monitoring implementation, and - Natural resource management transfer while takes in account property rights.	
4.4 Key actors and stakeholders, including the private sector, are engaged in partnership to implement the Convention and are integrating biodiversity concerns into their relevant sectoral and cross-sectoral plans, programmes and policies.	The private sector integrates biodiversity consideration into their development.	- Adoption by primary banks of a measure to finance only environment compliant Investments, - Increasing ecotourism and the value of biodiversity within the tourism sector, and - The strategy of the Access and sharing of the advantages from the use of natural resources in progress.	

C. CONCLUSION

Madagascar ratified the Biological Diversity Convention in 1997. We can affirm that the Convention has played an essential role in the global biodiversity conservation, as well as for harmonization of actions and fund raising. It serves as the main reference for regional synergies on natural resource management. At the national level, the national strategy for sustainable management of biological diversity has been proved as an effective implementation instrument.

The National Environmental Action Plan (NEAP) covers most of the priorities detailed under the national strategy. Its implementation has been supported by bilateral and multilateral donors, technical cooperation organizations, and international nongovernmental NGOs.

For Madagascar, the extension of protected areas and the setup of sustainable funding mechanisms are on track. More efforts are necessary to improve knowledge of the biological diversity's status. Other actions, such as the sustainable management of species trade with high international demand, have not reached the right level. Positive results and behavioral changes are limited by poverty. The sharp increase in illegal logging and collecting has become a matter of recent concern, given the socio-political strife currently affecting the country.

Climate change has generated new stakes for tropical forests and coral reef areas which serve as biodiversity reservoirs, hydrological reservoirs, and carbon traps. New focuses for research and ecological monitoring are emerging to explore the relationship between the actual impact of climate change on biodiversity and species' adaptation to the phenomenon. Additional knowledge and new capacities are needed in this area. On the other hand, establishing sustainable management models for the various sectors and mechanisms for equitable benefits sharing remain topical issues.

Finally, it is highly necessary to update the national strategy for sustainable management of biodiversity and to build synergies between this strategy and the national vision on climate change.

Antananarivo – August 19, 2009

APPENDIXES

APPENDIX 1

INFORMATION CONCERNING REPORTING PARTY AND PREPARATION OF NATIONAL REPORT

A. REPORTING PARTY

Contracting Party	Madagascar
CONTACT OFFICER FOR NATIONAL REPORT (IF DIFFERENT FROM ABOVE)	
Full name of the institution	Ministry of Environment and Forests
Name and title of contact officer	Rasoavahiny Laurette Herimine. Director of Protected Areas System and CDB Focal Point
Mailing address	Forest General Direction In Nanisana Antananarivo- Madagascar
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Fax	
E-mail	sapm.dgeef@gmail.com dsap@meeft.gov.mg
SUBMISSION	
Signature of officer responsible for submitting national report	
Date of submission	

B. PROCESS OF PREPARATION OF NATIONAL REPORT

This report describes the progress and the achievements of the country relative to the 2010 targets and to the convention's strategic plan. The Ministry of Environment and Forests is responsible for the submission of this report and for the implementation of the Environmental Program and several international conventions, including the Convention on Biological Diversity, the Convention on Climate Change, the Convention to Combat Desertification, and others which relate to the management of the environment and biological diversity.

This report was prepared using a participatory process, involving a series of national workshops and thematic working groups.

The development of this fourth national report, coordinated by the Ministry of Environment and Forests, was completed in collaboration with:

The Ministry of Agriculture, Livestock and Fisheries, the Ministry of Culture and Tourism, the Ministry of Economy, Trade and Industry, the Ministry of Decentralization and Territorial Management, the Ministry of National Education and Scientific Research, the Ministry of Energy and Mines, the Ministry of Public Works and Meteorology, the Ministry of Water, the Ministry of Health, and the Ministry of Transportation;

Universities, National Institutions, and Environmental Agencies: the Department of Plant Biology and the Department of Animal Biology at the University of Antananarivo, the Agency of Ports, Marines and Coastal , Civil Aviation of Madagascar, the National Center for the Implementation of Pharmaceutical Research, the National Centre for Environmental Research, the Economic Development Board of Madagascar, the "Foibe Fikarohana momba ny Fambolena", the Institute for Fishing and Marine Sciences of Madagascar, Madagascar National Parks, the National Environment Office, the Tsimbazaza Botanical and Zoological Park, the Support Service for Environmental Management, and the National Silo of Forest Seeds;

Non-governmental organizations and associations : Amphibian Specialist Group for Madagascar, ASITY Madagasikara, World Mountain People Assocation, California Academy of Sciences, Conservation International, Durrell Wildlife Conservation Trust, Kew Botanical Garden, Primate Research and Study Group, Madagascar Plant Specialist Group, Institute for the Conservation of Tropical Environments/MICET, Langaha, Millenium Challenge Account, Missouri Botanical Garden, Madagasikara Voakajy, the Peregrine Fund, UNDP, JARIALA, Geman-Malagasy Environment Program, Vahatra, Wildlife Conservation Society, and World Wildlife Fund;

National focal points for international conventions related to the environment and management of biological diversity: the Conventions on the Dumping of Hydrocarbons, POPs, combating desertification, climate changes, Nairobi Convention, Biosecurity, RAMSAR, CITES, AEWA, CMS, and the Convention on the Protection of Cultural and National World Heritage.

APPENDIX II

FURTHER SOURCES OF INFORMATION

A. EXPLANATORY STATEMENT: REDESIGN OF THE CODE OF MANAGEMENT OF PROTECTED AREAS

SUBJECT: Bill on the Reform of the Code of Protected Areas Management in Madagascar.

Members of Parliament,

This bill reforming the Code of Protected Areas Management of Madagascar follows the commitment made by the President of the Republic in his speech at the World Parks Congress in Durban, on September 2003, to increase Madagascar's protected areas from 1.7 to 6 million hectares.

The implementation of the Durban Vision, aiming to triple the coverage of protected areas, revealed the limits of Act 2001-15 of February 11, 2003, on the Code of Protected Areas. This act could be a factor inhibiting progress.

The overhaul of the Act is necessary in light of the principles developed by the International Union for Conservation of Nature (IUCN), notably to:

- Allow for modernized management of protected areas,
- Ensure openness to new types of actors and management methods,
- Promote sustainable use of natural resources for development and the poverty reduction.

Thus, this act creates the Protected Area Network of Madagascar, a structured and coherent network of all protected areas, regardless of their type, including approved private protected areas, community protected areas and marine protected areas.

This act is comprised of 75 articles, divided among five titles.

These, Mr. President of the Senate, Mr. President of the National Assembly, and honourable members of parliament, are the motivations of the bill that I have the honor of submitting to you for your approval.

Antananarivo

THE MINISTER OF THE ENVIRONMENT, FORESTS AND TOURISM

RANDRIARIMANANA Harison Edmond

B. DESCRIPTION OF SOME COMMERCIALSPECIES OF PLANT PROPOSED TO THE CITES.

Table 37: Description of Some Commercially Plant Species Proposed to the CITES

Scientific Name	Current State	Trends	Threats	Suggested or Possible Conservation Measures
Adenia firingalavensis (Passifloraceae)	Endemic species Wide distribution in Madagascar, Found in western regions: Mikea Forest, Andoharano Forest (North of Toliary), in Ankarana and Analamerana Special Reseves, and Montagne d'Ambre National Park, Approximately 150 individuals found in Andoharano Forest, and Growth is slow and regeneration difficult.	The number of plants exported peaked in 2004 (358) and was lower in 2005 (168 plants).	Number of individuals in operators' natural habitat collection sites is low.	-Addition of the species to CITES Appendix 2, -IUCN status Vulnerable (VU), and -Implementation of ex situ multiplication program.
Adenia olaboensis (Passifloraceae)	Endemic species, Wide distribution in Madagascar Found at Ampandrandava (Betioky district), at Antsalova (North of Belo sur Tsiribihina), in the ex-provinces of Toliary, Mahajanga and Fianarantsoa, Approximately 250 stems were found in the South from Tongobory in Andriamananga Forest to Ambovombe,	The number of plants exported decreased in 2005 (184 plants).		-Addition of the species to CITES Appendix 2, -IUCN status Vulnerable (VU), and -Implementation of ex situ multiplication program.
Adenia subsessifolia (Passifloraceae)	Distribution relatively wide but the zone of occurrence is fragmented and localized: Toliary region: Toliary Table, Cap Sainte Marie Special Reserve, Behara Amboasary Sud Approximately100 individuals were counted at Toliary Table (operators' collection zone). Populations at the two other sites, Cap Sainte Marie et Behara are less than 50 mature individuals Low regeneration rate: 35 %	This species was mainly exported in 2004 (115 plants)	Overexploited collection Zones	-Addition of the species to CITES Appendix 2, -IUCN status Vulnerable (VU), and -Implementation of ex situ multiplication program.

Scientific Name	Current State	Trends	Threats	Suggested or Possible Conservation Measures
Cyphostemma elephantopus (Vitaceae)	Endemic species Found in the southern region (Toliary Table: Ankilibe, North of Toliary: Tsingoritelo) and southwest (Toliary and Tsimanampetsotsa) Approximately 500	Highest level of exportation was in 2004 (563 plants)	This species grows in areas that are unprotected and therefore under strong anthropogenic pressures. The habitat of this	-Addition of the species to CITES Appendix 2, -IUCN status Vulnerable (VU), -Establishment of habitat protection program, and

	individuals were counted at Andatabo et à Tsingoritelo, Nord de Toliary and surrounding areas Few individuals remaining		species near the road to Ifaty is found in "swimming areas" for hotel construction, and the habitat at Ankilibe Andatabo is on private property. The rapid destruction of this species' habitat could cause its extinction in the short term if no measures are taken.	Implementation of ex situ reproduction program.
Cyphostemma laza ((Vitaceae)	Endemic species Found in two regions of the island: the North (Antsiranana) and the Souht (Toliary) Approximately 250 were counted in Andoharano Forest North of Toliary, Tongobory Forest, Betioky, and in Elomaka Forest Amboasary Sud (collection zones)	The number of plants sold internationally has increased consistently since 2003. In 2006, the exportation of 7,814 plants was recorded.	Distribution area is threatened by anthropogenic pressures. Uncontrolled, large-scale exploitation for international commerce constitutes a long-term threat for the species.	-Addition of the species to CITES Appendix 2, -IUCN status Vulnerable (VU),and -Submit exploitation and exportation for international regulation.
O*perculicarya decaryi* (Anacardiaceae)	Endemic species Wide distribution Found in the ex-province of Toliary between Tongobory (Betioky) and Amboasary Sud, 440 individuals were found at Tongobory in 2006. Other sites have similar numbers.	The number of plants sold internationally has increased consistently since 2003. In 2006, the exportation of 2,647 plants was recorded.		Addition of the species to CITES Appendix 2, IUCN status Vulnerable (VU).

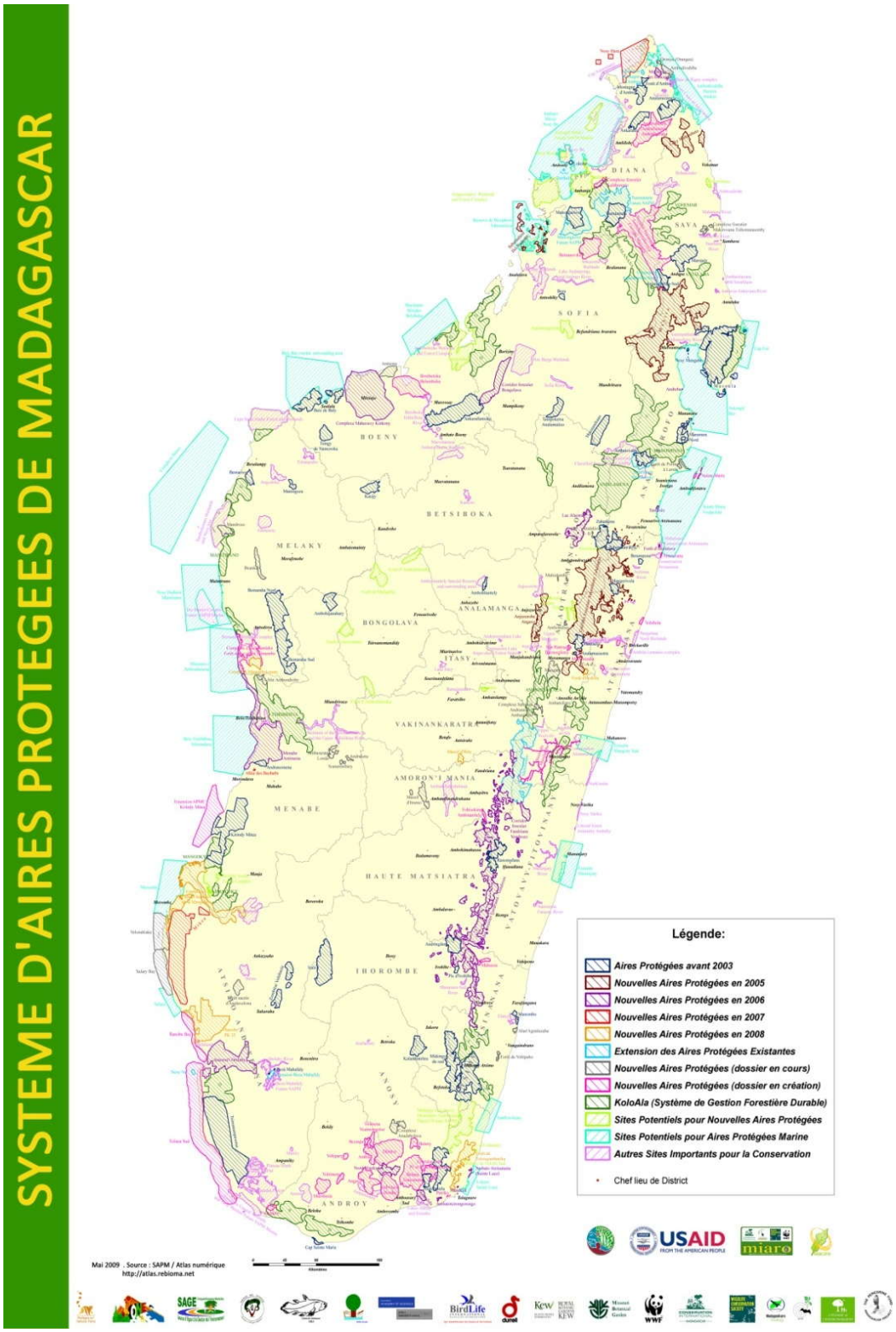
Source : Amendement et annotation de quelques espèces malgaches, 2007.

Scientific Name	Current State	Trends	Threats	Suggested or Possible Conservation Measures
O*perculicarya hyphaenoides* (Anacardiaceae)	Endemic species, Fragmented distribution, and Found only in several sites in southern Madagascar (Tsimanampetsotsa, Bemananteza, Zohin'i Mitoho and Toliary Table) 550 stems were found in 2006 from Toliary Table to Sainte Augustin.	The number of plants exported continues to increase. In 2006, the exportation of 395 plants was recorded.	The species is found in unprotected areas and are subjected to strong anthropogenic pressures, such as fire and damaging collecting practices.	-To be include to CITES Appendix 2, -IUCN status Endangered (EN), and -Habitat protection appears necessary to preserve the wild population.
Senna meridionalis (Fabaceae)	Endemic species, Highly fragmented distribution, Found in Madagascar's south (Toliary Table) and southwest (Tsingy of Bemaraha) Approximately 420 individuals were found in 2006 at Ahaviro (Toliary	The number of plants exported peaked in 2004 (483 plants) and was lower in 2005 (166 plants).	Exportation could lead to a lack of natural regeneration and population decline, possibly leading to the loss of wild populations in the long term. The most sought-	-Addition of the species to CITES Appendix 2, -IUCN status Vulnerable (VU), and -Habitat protection at Toliary Table appears necessary to preserve the wild

	Table), of which 150 adult plants.		after form of this species grows at Toliary Table, which is an unprotected area subjected to strong anthropogenic pressures, such as fire.	population.
Zygosicyos pubescens (Cucurbitaceae)	Endemic species Very narrow geographic distribution Only one locality known: Ekodida Forest (Amboasary Sud) 150 individuals were recorded within 3 ha at Ekodida Forest	The species is not exported in high quantities; only 32 plants were exported in 2006	The species grows in unprotected areas subjected to strong anthropogenic pressures	-Addition of the species to CITES Appendix 2, -IUCN status Endangered (EN), -Implementation of ex-situ reproduction program, -Only plants ex situ reproduction allowed to be sold.
Zygosicyos tripartitus (Cucurbitaceae)	Endemic species, Very narrow and fragmented distribution, and Found in Madagascar's south (northeast limit of Androy), and center: upper Mandrare basin, Manambolo valley, Mandrare valley, Tranomaro 900 individuals were counted at Ambarazy and Andrahomana forests in the Rural Commune of Tranomaro.	The number of plants exported continues to increase. The exportation of 1,845 plants was recorded in 2006.	This species grows in unprotected areas and are therefore subjected to strong anthropogenic pressures. This species also suffers from trampling by cattle, which inhibits its regeneration.	-Addition of the species to CITES Appendix 2, -IUCN status Vulnerable (VU), and -Implementation of ex-situ reproduction program.

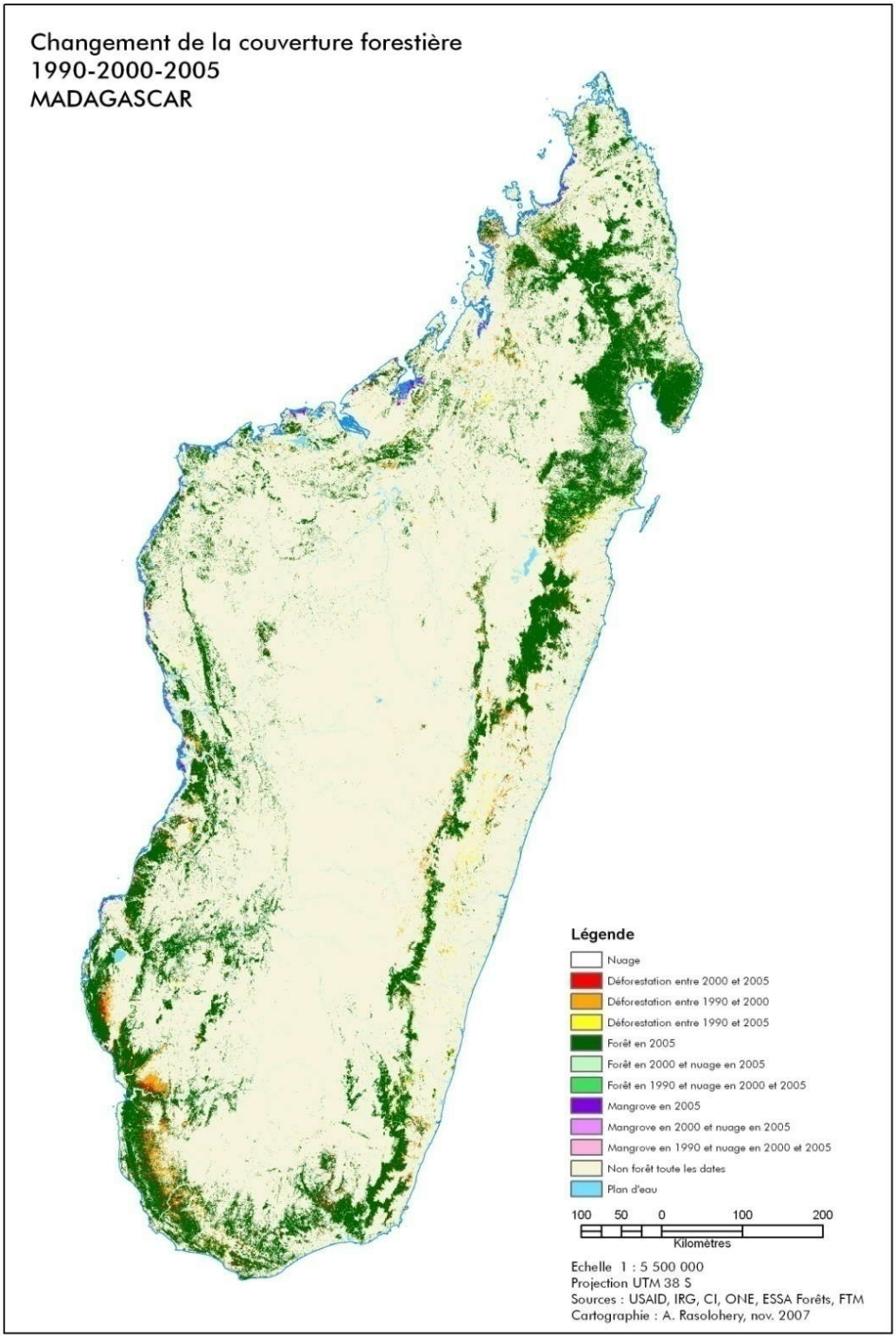
Source : Amendement et annotation de quelques espèces malgaches, 2007

MAPS



Map 1: The System of Protected Areas of Madagascar

(Source : Atlas du Système des Aires Protégées de Madagascar-Mars 2009/ Commission SAPM/REBIOMA)



Map 2: Change in Forest Cover in Madagascar from 1990 to 2005.

(Source Conservation International, 2007)

APPENDIX III

A. PROGRESS TOWARDS TARGETS OF THE GLOBAL STRATEGY FOR PLANT CONSERVATION

Table 38: Progress towards targets of the global strategy for plant conservation

Global Targets	Achievements	Comments
Target 1: A widely accessible working list of known plant species, as a step towards a complete world flora.	1) Herbarium TAN (Botany Department in PBZT) consists almost entirely of herbarium specimens: -Total number of specimens: 130,000 -Number of type specimens: 800 2) Herbarium TEF (DRFP) For the TEF herbarium, there are herbarium specimens and samples of wood. * Herbarium specimens -Total number of specimens: 60 000 -Number of type specimens: 700 * Wood specimens -Total number of specimens: 10,504 -Number of type specimens: 1,928 2) Scientific publications and databases available on Internet.	
Target 2: A preliminary assessment of the conservation status of all known plant species, at national, regional and international levels.	During the period 2008-2009, the total number of species with IUCN status rose to 1,848, including 504 species in the category "critically endangered", 868 "endangered", and 476 “vulnerable".	
Target 3: Development of models with protocols for plant conservation and sustainable use, based on research and practical experiences.	The conservation status of 350 endemic wild food plants have been evaluated in the project in collaboration with BGCI the GSPM.	
Target 4: At least 10% of each of the world’s ecological regions effectively conserved.	The area of the Protected Areas is currently 4,751,895 ha, distributed across the ecological regions of Madagascar, covering about 8% of the area of the island.	79% of the 2012 target achieved.
Target 5: Protection of 50 per cent of the most important areas for plant diversity assured.	77 Important Areas for Plants (or ZIP) with an area of 2,900,000 ha have been identified and prioritized in the new protected areas (NPA). Currently, an area of 4,751,895 ha is under legal protection. 47 Important Areas for Plants in the existing AP were identified.	The results of the work by MBG for determining priority areas for plant conservation in Madagascar have been used for the determination of NAP.

Source: Madagascar Plants Specialists Group, 2009

Global Targets	Achievements	Comments
Target 6: At least 30 per cent of production lands managed consistent with the conservation of plant diversity	-Watershed management projects implemented in different sites such as in Alaotra, Betsiboka basin, etc, - About 500 cases of natural resources management transferred to local communities, about 178,000 ha of forests. -Find solutions for people who are living within proposed protected areas.	
Target 7: 60 per cent of the world's threatened species conserved in situ.	*In situ* conservation is achieved through the creation of protected areas (4,751,895 ha have been protected), forest stations, classified forests, and corridors.	.
Target 8: 60 per cent of threatened plant species in	The ex-situ conservation of plants is ensured by state institutions:	

accessible *ex situ* collections, preferably in the country of origin, and 10 per cent of them included in recovery and restoration programmes	1) the Botanical and Zoological Park of Tsimbazaza or "Parc Botanique et Zoologique de Tsimbazaza" (PBZT), which houses an arboretum including a pandanus and palm grove, a rock garden of endemic xerophytic plants, a greenhouse, a garden and a center for orchids reproduction, and for ferns, 2) The National Center for Implementation of Rural Development Research or "Centre National de Recherche Appliquee au Developpement Rural" FOFIFA maintains germplasm of cultivated plants and collections of wild relatives of crops. The largest collection is Kianjavato and contains some 50 species of *Mascarocoffea*, 3) The National Center for Applied Pharmaceutical Research or "Centre National Appliqué aux Recherches Pharmaceutiques" (CNARP) has a collection of medicinal plants, 4) Forest stations managed by the Direction of Environment and Forest also provide germination assays and propagation of forest trees and orchids (e.g., Andasibe forest station), 5) The National Silo for Forest Seeds or "Silo National des Graines Forestières" (SNGF) has a seed bank available for commercial purpose, 6) Private organizations managing botanical gardens. One of the best known in Madagascar is the Antsokay arboretum located in Tuléar, which has a collection of xerophytic thicket plants from southern Madagascar, 7) The Malagasy Institut for Applied Research or "Institut Malgache de Recherche Appliquée" (IMRA) maintains a collection of medicinal plants, 8) Religious bodies like the Jesus Christ Madagascar Church of "Eglise de Jésus Christ à Madagascar", which has established a botanical garden with FOFIFA in Ranomafana, 7) Abroad there are seed banks, germplasm, and vegetable tissue banks; neither the importance of these collections nor their target species is known. For example, we know that the Omaha Zoo in the United States has a collection of all forms of orchids from Ranomafana. Investigations should be made regarding the international inventory of *ex situ* plants collected from Madagascar, and 8) To enforce CITES, all operators for flora species trade contributed to *ex situ* plants.	

Source: Madagascar Plants Specialists Group, 2009

Global Targets	Achievements	Comments
Target 9: 70 per cent of the genetic diversity of crops and other major socio-economically valuable plant species conserved, and associated indigenous and local knowledge maintained	1) In Madagascar, the efforts of the project PSPC cover a number of priority types, including *Dioscorea*, *Oryza*, *Musa*, *Coffea*, and *Vanilla*. Other genera have been added during the project. The database project currently maintains information on 163 species, including species belonging to priority taxa and 25 other species within the genera *Amorphophallus, Cinnamosma, Garcinia, Ipomea, Diospyros, Olea, Peperomia, Piper, Sclerocarya, Solanum, Citrus,* and *Tacca*	
Target 10: Management plans in place for at least 100 major alien species that threaten plants, plant communities and associated habitats and ecosystems	Measures against the invasion of *Opuntia stricta* in the Androy region are underway	

Target 11: No species of wild flora endangered by international trade	32 plant species are listed in Appendix I of CITES of Madagascar (2 *Pachypodium*, 1 palm, 16 *Aloe*, 9 *Euphorbia*, and 3 Orchidaceae), Families listed in Appendix II are Euphorbiaceae, Apocynaceae, Orchidaceae, Didiereaceae, Liliaceae, Palmae, Cyatheaceae, Cycadaceae, Nepenthaceae, Rosaceae, Cactaceae and Asclepiadaceae, Malagasy CITES regulations have not yet formally established an Appendix III. However, the Malagasy species traded internationally that are not yet included in Appendices I and II, are already governed by specific legislation at the national level, and The determination of the export quota for commercial plants is a task that remains to be completed for most species. Collected data could be used for refinement of the categorization of the different species within the various appendices of CITES.	Madagascar ratified CITES, and has an action plan that enables it to comply with the objectives of CITES. In support of the management authority which is the Direction of Environment and Forest, a scientific authority (composed by plant experts from the Botany and Plant Ecology Department at Sciences Faculty of Antananarivo) on flora has been in place since 2004, thus providing a scientific basis for managing CITES species.
Target 12: 30 percent of plant-based products derived from sources that are sustainably managed .	-Establishment KOLOALA sites (sites for sustainable use) are ongoing, -Management plans for sites and natural resources to exploit are implemented, and -Implementation of product tracking is ongoing.	

Source: Madagascar Plants Specialists Group, 2009

Global objectives	Achievements	Comments
Target 13: The decline of plant resources, and associated indigenous and local knowledge innovations and practices that support sustainable livelihoods, local food security and health care, halted.	Despite efforts against threats (land clearing, wild fires, illegal logging, etc.), the depletion of plant resources persists, Data on medicinal and food plants compiled (e.g., Plant Resources of Tropical Africa or PROTA)	
Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes.	-All ministries have an environmental division unit operating, -Integration of the environmental program into the educational curriculum, and -Publications on Malagasy plants have been produced (e. g., *Tohiravina*, an annual publication on ecological monitoring of plants and *Honko*, a publication on mangroves).	
Target 15: The number of trained people working with appropriate facilities in plant conservation increased, according to national needs, to achieve the targets of this Strategy.	-Projects include in their goals the training of technical staff and material support. Such is the case for the Global Taxonomic Initiative (GTI), etc. -Most universities in the six former provinces have at least one department related to the environment.	
Target 16: Networks for plant conservation activities established or strengthened at national, regional and international levels	-Important Plant Areas (or IPA) have been identified and prioritized in the new protected areas (NPA), - Development of participants in the conservation of plant biodiversity (providing scientific data, implementation of policy and programs, development of a system of partnership, implementation of conservation actions, compilation of plant resources, and agricultural research), - PROTA (Plant Resources of Tropical Africa), a database of useful plants, available, -The National Silo for Forest Seeds or "Silo national des graines forestières" (SNGF): collection, sale and conservation of species, -Malagasy node of GBIF (Global Biodiversity Information Facility): whose mission is to facilitate the digitization and dissemination worldwide, especially in developing countries, of data on biodiversity, -The Madagascar Biodiversity Network or "Réseau de la biodiversité de Madagascar" (REBIOMA) established: a biodiversity database managed by WCS in conjunction with GBIF, -The Association Network of Environmental Information System or "Association du Réseau des Systèmes d'Information Environnementale" (ARSIE), - The Global Taxonomic Initiative (GTI): research on taxonomy in progress, and - The "Clearing House Mechanism of Madagascar" managed by ONE develops data on flora, fauna and the ecological and biogeographic characteristics of the 22 regions of Madagascar.	

Source: Madagascar Plants Specialists Group, 2009

B. PROGRESS TOWARDS THE IMPLEMENTATION OF THE PROGRAMMES OF WORK ON PROTECTED AREAS

Table 39: Progress towards the implementation of the programmes of work on protected areas

Goals	Objectives	Achievements
1.1. To establish and strengthen national and regional systems of protected areas integrated into a global network as a contribution to globally agreed goals.	By 2010, terrestrially includes inland water ecosystem and 2012 in the marine area, a global network of comprehensive, representative and effectively managed national and regional protected area system is established as a contribution to (i) the goal of the Strategic Plan of the Convention and the World Summit on Sustainable Development of achieving a significant reduction in the rate of biodiversity loss by 2010; (ii) the Millennium Development Goals – particularly goal 7 on ensuring environmental sustainability; and (iii) the Global Strategy for Plant Conservation.	The actual total protected area (definitive and temporary) covers 4.7 million ha (approximately 8% of the country) and 79% of the 2012 Durban Vision.
1.2. To integrate protected areas into broader land- and seascapes and sectors so as to maintain ecological structure and function.	By 2015, all protected areas and protected area systems are integrated into the wider land- and seascape, and relevant sectors, by applying the ecosystem approach and taking into account ecological connectivity [5]/ and the concept, where appropriate, of ecological networks.	-All effective ecosystems represented within new protected areas, -Connectivity maintained by 30 new protected areas (terrestrial and marine) currently being established.
1.3 To establish and strengthen regional networks, transboundary protected areas (TBPAs) and collaboration between neighboring protected areas across national boundaries.	Establish and strengthen by 2010/2012 [6]/ transboundary protected areas, other forms of collaboration between neighboring protected areas across national boundaries and regional networks, to enhance the conservation and sustainable use of biological diversity, implementing the ecosystem approach, and improving international cooperation.	
1.4. To substantially improve site-based protected area planning and management.	All protected areas to have effective management in existence by 2012, using participatory and science-based site planning processes that incorporate clear biodiversity objectives, targets, management strategies and monitoring programmes, drawing upon existing methodologies and a long-term management plan with active stakeholder involvement	-Guidelines for protected area creation and management (including Conservation guidelines and social safeguards guidelines) are developed and -Creation of new protected areas managed by local communities or co-managed with local communities in progress.
1.5. To prevent and mitigate the negative impacts of key threats to protected areas.	By 2008, effective mechanisms for identifying and preventing, and/or mitigating the negative impacts of key threats to protected areas are in place.	-Fire satellite tracking is operational, - Monitoring and control of protected areas are ensured by park agents and local communities' participation.
2.1. To promote equity and benefit-sharing.	Establish by 2008 mechanisms for the equitable sharing of both costs and benefits arising from the establishment and management of protected areas	-The protected area entry fees sharing (DEAP) is operational and has benefited the local population and - Development of legislation on benefits sharing is on the track.
2.2. To enhance and secure	Full and effective participation by 2008, of	-Integrated approach applied to marine

[5]/ The concept of connectivity may not be applicable to all Parties.

[6]/ References to marine protected area networks to be consistent with the target in the WSSD plan of implementation.

Goals	Objectives	Achievements
involvement of indigenous and local communities and relevant stakeholders.	indigenous and local communities, in full respect of their rights and recognition of their responsibilities, consistent with national law and applicable international obligations, and the participation of relevant stakeholders, in the management of existing, and the establishment and management of new, protected areas	ecosystems management (marine resource conservation, fishing management, etc.), -Management of buffer zones are ensured by communities by official transfer, -On going training activities on co-management of protected areas.
3.1. To provide an enabling policy, institutional and socio-economic environment for protected areas.	By 2008 review and revise policies as appropriate, including use of social and economic valuation and incentives, to provide a supportive enabling environment for more effective establishment and management of protected areas and protected areas systems..	- Overhaul of COAP-(Code of Protected Areas) to suit different IUCN categories of conducted, the relevant law is being enacted, - Environmental and social impact studies became a prerequisite for protected areas creation, - Population affected by the plan to create a protected area (PAP) identified, - Environment and Social Management Plan) or a Safeguard Plan established, and -Public Consultations conducted during protected areas creation.
3.2. To build capacity for the planning, establishment and management of protected areas.	By 2010, comprehensive capacity building programmes and initiatives are implemented to develop knowledge and skills at individual, community and institutional levels, and raise professional standards.	-Training performed by the Conservation Network of Educators and Practitioners (REPC), -Various training courses for the creation and management of the APs conducted, for example: establishment of a environmental and social management plan, establishment of a development plan (by using MIRADI), co-management of protected areas, guide for the creation of SAPM protected areas, practical guide for the governance of protected areas in Madagascar, guide on community consultation, guide for the sustainable use of natural resources in protected areas.
3.3. To develop, apply and transfer appropriate technologies for protected areas	By 2010 the development, validation, and transfer of appropriate technologies and innovative approaches for the effective management of protected areas is substantially improved, taking into account decisions of the Conference of the Parties on technology transfer and cooperation.	-Participation of communities in: forest zoning, establishment of management plans, the establishment and implementation of the business plan, and the establishment of Protected Areas projects.
3.4. To ensure financial sustainability of protected areas and national and regional systems of protected areas	By 2008, sufficient financial, technical and other resources to meet the costs to effectively implement and manage national and regional systems of protected areas are secured, including both from national and international sources, particularly to support the needs of developing countries and countries with economies in transition and small island developing States.	The protected area foundation is set up and operational: 52 million USD has been raised.
3.5. To strengthen communication, education and public awareness.	By 2008 public awareness, understanding and appreciation of the importance and benefits of protected areas is significantly increased	-Education and environmental awareness is a component prioritized activities for protected area managers, -All government ministries have their operational environmental units, - Public awareness was conducted during

Goals	Objectives	Achievements
		the environmental events such the celebration of the global environmental day, - Integration of the environmental program national education curriculum.
4.1. To develop and adopt minimum standards and best practices for national and regional protected area systems.	By 2008, standards, criteria, and best practices for planning, selecting, establishing, managing and governance of national and regional systems of protected areas are developed and adopted.	-Planning System of Protected Areas standardized by using the program MIRADI, - Protected Areas conservation Management Plan implemented.
4.2. To evaluate and improve the effectiveness of protected areas management.	By 2010**,** frameworks for monitoring, evaluating and reporting protected areas management effectiveness at sites, nati onal and regional systems, and transboundary protected area levels adopted and implemented by Parties.	Adoption of the 5S planning system in Protected Areas managed by the MNP
4.3. To assess and monitor protected area status and trends.	By 2010, national and regional systems are established to enable effective monitoring of protected-area coverage, status and trends at national, regional and global scales, and to assist in evaluating progress in meeting global biodiversity targets	- Environmental dashboard for 22 Regions (TBE) updated regularly, - Monitoring System established in the National Program on Protected Areas.
4.4 To ensure that scientific knowledge contributes to the establishment and effectiveness of protected areas and protected area systems.	Scientific knowledge relevant to protected areas is further developed as a contribution to their establishment, effectiveness, and management	Scientific databases of Protected Areas are available at REBIOMA (Network of Madagascar Biodiversity) managed by the WCS (Wild Conservation Society) / website: http / / atlas.rebioma.net

ABBREVIATIONS

ACCA	Adaptation aux Changements Climatiques en Afrique
ACE	Animateurs Communautaires de l'Environnement
AS	Autorité Scientifique
ACP	Afrique Caraïbe Pacifique
ATM	Accord Type de Transfert de Matériels
ACSAM	Action Stratégique pour la Conservation des Amphibiens de Madagascar
ADEMA	Aéroport De Madagascar
AETFAT	Association pour l'Etude taxonomique de La Flore d'Afrique Tropical
AEWA	Accord sur les Oiseaux d'Eau Migrateurs d'Afrique Eurasie
AFD	Agence Française pour le Développement
AMNH	American Museum Natural History
AMP	Aires Marines Protégées
ANAE	Association Nationale d'Action Environnementale
ANDEA	Autorité Nationale de l'Eau et de l'Assainissement
ANGAP	Association Nationale de Gestion des Aires Protégées
AP	Aire Protégée
APA	Accès et Partage des Avantages
ARPEGE	Appui Régional à la Promotion d'une Education pour la Gestion de l'Environnement
ASG	Amphibian Specialist Group
BAD	Banque Africaine de Développement
BV-PI	Bassin Versant-Périmètre Irrigué
BM	Banque Mondiale
CCE	Cahier de Charge Environnementale
CFC	Chloro Fluoro- Carbone
CAMP	Conservation Analysis and Management Plan
CMS	Convention relative à la Conservation des Espèces Migratrices Appartenant à la Faune Sauvage
CAZ	Corridor Ankeniheny Zahamena
CCNUCC	Convention Cadre des Nations Unies sur les Changements Climatiques
CDB	Convention sur la Diversité Biologique
CES	Commerce Equitable et Solidaire
CFAMA	Centre de Formation et d'Application du Machinisme Agricole
CHD1/ CHD2	Centre hospitalier de District Niveau 1 et de Niveau 2
CHM	Center House Mechanism
CHRR	Centre Hospitalier Régional de Référence
CI	Conservation International
CIREF	Circonscription des Eaux et Forêts
CITES	Convention Internationale pour le Commerce Des Espèces Menacées
CNARP	Centre National d'Application de Recherche Pharmaceutique
CNCC	Comité National pour la Commercialisation du café
CNFEREF	Centre National de Formation
COAP	Code des Aires Protégées
COFFAV	Corridor Forestier Fandriana Vondrozo

COI	Commission de l'Océan Indien
CONARAMS	Comité National Ramsar
CR	Commune rurale
CR	En danger critique d'extinction
CRD	Conseil Régional de Développement
CSG	Crocodile Specialist Group
CLD	Convention sur la Lutte contre la Désertification
CTE	Comité Technique d'Evaluation
CTHA	Centre Technique et Horticole d'Antananarivo
CTHT	Centre Technique et Horticole de Toamasina
DD	Data Deficient
DGE	Direction Générale de l'Environnement
DRFP	Département de Recherches Forestière et Piscicole
DGEF	Direction Générale de l'Environnement et des Forêts
DRDR	Direction Régionale de développement Rural
DWCT	Durrell Wildlife Conservation Trust
EAF	Ecosystemic Approach in Fisheries
EIE	Etude d'Impact Environnemental
EIES	Etude d'Impact Environnemental et Social
EMC	Environnement Marin et Côtier
FAMAMA	Famokarana Mahabibo Malagasy
FDHS	Forêt Dense Humide Sempervirente
FOFIFA	Centre National de Recherche Appliquée au Développement Rural
FAO	Food Agricultural Organization
FAPBM	Fondation Pour les Aires Protégées et la Biodiversité de Madagascar
FFEM	Fonds Français pour l'Environnement Mondial
FIFAMANOR	Coopération Madagascar-Norvège pour le Développement de l'élevage et de l'Agriculture
GNEV	Groupement National des Exportateurs de Vanille
GEF	Global Environment Facility
GERP	Groupe d'Etude et de Recherche sur les Primates
GIRE	Gestion Intégrée de la Ressource en Eau
GSPM	Groupe des Spécialistes des Plantes de Madagascar
ICTE	Institute for Conservation of Tropical Environment
GRAP	Gestion du Réseau National des Aires Protégées
IEC	Information Education Communication
IMRA	Institut Malgache de Recherches Appliquées
IATA	International Association de transport aérien
ICBG	International Corporating Biodiversity Group
IRRI	International Rice Research Institute
IRD/	Institut de Recherche pour le Développement
IPGRI	International Plant Genetic Resources Institute
JICA	Japan International Cooperation Agency
MAEP	Ministère de l'Agriculture, de l'Elevage et de la Pêche
MADERE	Matériel Didactique Relative à l'Education Environnementale
MENRS	Ministère de l'Education Nationale et de la Recherche Scientifique

MEF	Ministère de l'Environnement et des Forêts
MNP	Madagascar National Parks (ex-ANGAP)
MBG	Missouri Botanical Garden
MECIE	Mise En Compatibilité de l'Investissement à l'Environnement
MSB	Millenium Seed Bank
NAP	Nouvelle Aire Protégée
ONG	Organisation Non Gouvernementale
ONE	Office National pour l'Environnement
OACI	Organisation de l'Aviation Civile Internationale
OG	Organe de Gestion
OGM	Organismes Génétiquement Modifiés
OLEP	Organe de Lutte contre l'Evénement de Pollution Marine Par les hydrocarbures
PADR	Plan d'Action pour le Développement Rural
PBZT	Parc botanique et Zoologique de Tsimbazaza
PERE	Politique de l'Education Relative à l'Environnement
PGE	Plan de Gestion Environnemental
PROGSEM	Programme de Semence
PGES	Plan de Gestion Environnemental et Social
PGEP	Plan de Gestion Environnemental du Projet
PGRM	Programme de Gouvernance des Ressources Minérales
PHVA	Population and Habitat Viability Analysis
PE	Programme Environnemental
PIC	Pôle Intégrée de Croissance
PLAE	Programme de Lutte Anti -Erosive
PLANGRAP	Plan de Gestion du Réseau des Aires Protégées
PLOF	Plans Locaux d'Occupation Foncière
PNDR	Plan National de Développement Rural
PNAE	Plan National d'Action Environnementale
POPs	Polluants Organiques Persistants
PREE	Programme d'Engagement Environnemental
ProGeCo	Programme Régional de Gestion Durable des Zones Côtières des Pays de l'Océan Indien
PNUD	Programme des Nations Unies pour le Développement
PNUE	Programme des Nations Unies pour l'Environnement
PROTA	Plant Resources of Tropical Africa
PPI	Programme de réhabilitation des Périmètres Irrigués
PSA	Plante sauvage Apparentée
PSDR	Projet de Soutien pour le Développement Rural
QMM	Qit Mineral Madagascar
RAP	Rapid Assessment Program
RBG	Royal Botanical Garden
REDD	Reducing Emissions from Deforestation and forest Degradation
REPC	Réseau des Educateurs Professionnels en Environnement
RPGAA	Ressources Phytogénétiques pour l'Alimentation et l'Agriculture
RRI	Result Rapid Initiative
SAICM	Strategic Approach to International Chemical Management

SAIM	Approche Stratégique de la Gestion Internationale des Produits Chimiques
SAPM	Système des Aires Protégées de Madagascar
SAGE	Service d'Appui à la gestion de l'Environnement
SNGDB	Stratégie Nationale pour la Gestion de la Diversité Biologique
SCV	Système de Couverture Végétale
SNGF	Silo National des Graines Forestières
SADC	South East African Development Community
TBE	Tableau de Bord Environnemental
TBER	Tableau de Bord Environnemental Régional
TDR	Termes de Référence
TFTSG	Tortoise and Freshwater Turtle Specialist Group
TIRPAA	Traité International sur les Ressources Phytogénétiques pour l'Agriculture et l'Alimentation
TIRTAA	Traité International sur les Ressources Phytogénétiques pour l'Alimentation et l'Agriculture
UICN	Union internationale pour la Conservation de la Nature
UADBA	Université d'Antananarivo, Département de Biologie Animale
USA	United states of America
USAID	United States Agency For International Development
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund

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