WWF (2010). Programme d'actions pour la conservation des tortues terrestres endémique du sud et sud-ouest de Madagascar Astrochelys radiata et Pyxis arachnoides, 2010-2015

WWF (2011). Reboisement Bois Energie dans le Sud-Ouest de Madagascar – Le bilan des trois campagnes. Synergie Energie Environnement dans le Sud-Ouest (SEESO),

WWF (2012). Rapport d'étude sur l'état des lieux du secteur mine de Madagascar,

WWF MWIOPO (2012). Reglementation de la filiere bois d'énergie dans la region Atsimo Andrefana, Acquis et leçons apprises, 2008 à 2011 : Programme WWF à Madagascar et dans l'Océan Indien Occidental

WWF, (2014). Etat des lieux du secteur Mines de Madagascar. Diagnostic dans le cadre du programme des industries extractives de MWIOPO (sous presse)

National Plans and Legislation :

MINENVEF (2010). Deuxième communication nationale to the UNFCCC.

SAPM & MEEF. 2009. Cadrage général du Système des Aires Protégées de Madagascar.

Plans Communaux de Développement (2005) PCD Région Atsimo Andrefana.

Plan Natinoal de Developpement, Madagascar 2015-2019

5ème rapport national de la Convention sur la Diversité Biologique de Madagascar (2014)

Décret N°2001-122 du 14 février 2001 Fixant les conditions de mise en œuvre de la gestion contractualisée des forêts de l'Etat

Décret N° 2013 – 785, Fixant les modalités de délégation de gestion des forêts de l'Etat à des personnes publiques ou privées du Ministère de l'environnement et des forets

Loi n° 96-025 du 30 septembre 1996 relative à la gestion locale des ressources naturelles renouvelables

Loi N° 96-018, Code pétrolier. 1996

Loi n°2015-005 portant refonte du Code de Gestion des Aires Protégées

Policy briefs :

Les Amis de la Terre France (2012). Synthèse. « Madagascar : nouvel eldorado des compagnies minières et pétrolières »

Policy Brief of the ICCA Consortium issue no. 1, The Contribution of Indigenous Peoples' and Local Community Conserved Territories and Areas to the Strategic Plan for Biodiversity 2011-20 (Aichi Targets)

Rio Tinto/QIT Madagascar Minerals SA, (2011). Développement durable : rapport 2011, p. 10 http://www.riotintomadagascar.com/pdf/RDD_2011_FR.pdf

10 Annexes

Annex 1: Co-Finance Letters

Name of Co-financier	Date of letter	Co-financing Amount ($)
HELVETAS Swiss Intercooperation, Madagascar *	05-May-2015	1,792,460
WELTHUNGERHILFE – WHH *	05-May-2015	1,639,213
Tany Meva	04-May-2015	350,000
Ministère de l'Agriculture	21-May-2015	38,000,000
Ader	14-May-2015	931,147
GIZ	02-Jun-2015	1,100,000
TOTAL		**43,812,820**

* Same letter for both organisations.

Refer to the PRODOC Addenda in a separate PDF file (or access the file by pasting this into a browser address bar: http://bit.ly/1PiE3CW).

Annex 2: Terms of Reference for Project Staff /Consultants

TORs in this PRODOC are provided in French to facilitate recruitment. They will be completed, dully formatted and validated during the appraisal phase.

Project Coordinator

Termes de références
COORDINATEUR DE PROJET

Titre : Coordinateur de projet
Superviseur : Directeur National du Projet
Lieu d'Affection : Tuléar
Durée d'intervention : Deux ans renouvelables

Contextes
Le paysage forestier épineux et sec d'Atsimo Andrefana, qui couvre une superficie de quelques 2,4 millions d'hectares est classé parmi les écosystèmes les plus distinctifs à Madagascar. C'est un écosystème fragile qui fait face à différentes pressions.
Constituant un refuge important pour la biodiversité, les écosystèmes du paysage assurent aussi par ses ressources naturelles la base de survie de la majorité de la population locale. De ce fait, la pression accrue due aux actions anthropiques (reconversion de terre forestière en terre de culture, exploitation, extraction minière...), rend vulnérables les ressources dernières vestiges du paysage. Conséquemment, il est crucial d'intégrer la gestion de la biodiversité dans le développement, et d'influencer l'aménagement du territoire, afin de contrôler les pressions dans les zones les plus sensibles du point de vue écologique : aires protégées (AP), zones adjacentes et corridors écologiques importants.

Conscient de l'importance de la biodiversité et le développement humain, un projet intitulé : « Approche paysage pour la conservation et la gestion de la biodiversité menacée à Madagascar, axée sur le paysage forestier épineux et sec d'Atsimo Andrefana » est mise en œuvre dans la région par le gouvernement avec l'appui financière de PNUD-FEM. Le projet va adopter une approche à deux volets. Tout d'abord, il renforcera la gouvernance de l'utilisation des ressources au niveau paysager. Pour cela, il élaborera et mettra en œuvre un plan de gestion de la biodiversité et des écosystèmes, en appui au schéma régional d'aménagement du territoire, à l'échelle du paysage, en incorporant explicitement les besoins en conservation de biodiversité et des processus écologiques. Il recommandera les utilisations des terres en vue d'atténuer les menaces, à partir d'un outil, le BD LUP. Il collaborera avec les parties prenantes au niveau national et régional, afin d'impliquer les secteurs du développement ainsi que le secteur privé, et négociera l'application des mesures environnementales et de conservation de la biodiversité, afin d'atténuer les impacts des investissements de grande envergure sur les écosystèmes fragiles.

Ensuite, le projet collaborera avec les communautés locales pour renforcer la conservation à base communautaire, en abordant le problème des menaces sur les écosystèmes et la biodiversité, en rapport avec les moyens de subsistance artisanaux. Il tiendra compte également de l'exclusion des communautés des processus décisionnels concernant les projets économiques de grande envergure en sensibilisant les communautés sur leurs droits à la consultation publique. Le projet travaillera avec les communautés pour établir des « Aires Protégées Communautaires » (APC) multi-usages, et mettra en place le cadre institutionnel nécessaire pour la gestion, ainsi que les mesures pour assurer l'utilisation durable des ressources naturelles, tout en renforçant la participation locale dans les processus décisionnels.

Objectifs
L'objectif de ce TDR est de cadrer les attributions du Coordinateur du projet une des personnes clés qui vont réaliser le projet.
Le Coordinateur du projet travaillera sous la supervision du Directeur National du Projet.

Attributions
Le coordinateur du projet sera en charge de la gestion du projet et aura comme tâche spécifiques de :

- Coordonner les planifications et mises en œuvre des deux composantes du projet

- Assurer la gestion quotidienne de la Composante 1 du projet
- Représenter le projet dans la région d'intervention
- Représenter le projet au niveau des plates-formes régionales
- Élaborer les plans opérationnels et budgets pour la Composante 1
- Établir les rapports périodiques du projet
- Veillez à la bonne mise en œuvre des activités
- Assurer la cohérence des interventions des deux composantes
- Suivre la bonne mise en œuvre du projet
- Assurer l'encadrement et suivi des consultants du projet
- Assurer l'organisation des interventions des différents experts gouvernementaux et des consultants dans le cadre du projet
-

Profil requis

Le candidat doit avoir au minimum les qualités suivantes :

- Titulaire d'un diplôme d'Ingénieur forestier BACC+5
- Au moins dix ans d'expériences dans le domaine de la conservation et du développement
- Au moins cinq ans d'expériences probantes en gestion de projet
- Expériences avec les projets financés par les bailleurs internationaux
- Maitrise de la politique environnementale et bonne connaissance des politiques sectorielles
- Bonne capacité de leadership
- Compétences à diriger une équipe multidisciplinaire
- Bonne connaissance du système d'information géographique
- Forte capacités d'analyse, de rédaction, de planification et organisations
- Apte à travailler avec un minimum de supervision
- Excellente maîtrise du français et bonnes connaissances de l'anglais
- Apte à travailler en équipe
- Bon sens relationnel
- La connaissance de la région Atsimo Andrefana serait un atout

Project Administrative and Financial Officer

Termes de références
RESPONSABLE ADMINISTRATIF ET FINANCIER

Titre : Responsable Administratif et Financier
Superviseur : Directeur National du Projet
Lieu d'Affection : Tuléar
Durée d'intervention : Deux ans renouvelables

Contextes

[même que pour le coord.]

Objectifs

L'objectif de ce TDR est de cadrer les attributions du Responsable Administratif et Financer une des personnes clés qui vont réaliser le projet.
Le Responsable Administratif et Financier travaillera sous la supervision du Coordinateur de Projet.

Attributions

Le Responsable Administratif et Financier sera en charge de la gestion des aspects administratifs et financier du projet et aura comme tache spécifique de :

- Assurer la gestion financière du projet
- Appuyer l'élaboration des budgets du projet
- Suivre les réalisations budgétaires du projet
- Veuillez à la conformité des dépenses aux normes et
- Établir et Consolider les rapports financiers
- Assurer la gestion des ressources humaines du projet

- Assurer la conformité de la gestion aux normes de travail à Madagascar

Profil requis
Le candidat doit avoir au minimum les qualités suivantes :

- Titulaire d'un diplôme de maitrise en gestion minimum
- 10 années d'expérience dans la gestion administrative et financière
- Au moins 5 années d'expérience avec les projets financés par les bailleurs internationaux
- Bonne connaissance des procédures des bailleurs
- Bonne maitrise des outils de gestion (logiciel)
- Forte compétence en comptabilité analytique
- Maitrise la langue française et anglaise
- Bonne maitrise de l'outil informatique de base (bureautique, e-mail, internet)
- Capacité rédactionnelle forte
- Bonne connaissance de la région Atsimo Andrefana serait un atout
- Ayant un bon sens de leadership
- Apte à travailler sous pression et respecte les délais
- Méthodique et ayant un bon sens de rigueur
- Dynamique, sociable et intègre

GIS Expert

Termes de références
DÉVELOPPEUR EXPERT EN SIG INTERNATIONAL

Devoirs et Responsabilités
Responsable de la réalisation de l'Activité 1.1.1, à partir de l'année 1, et d'autres activités/réalisations connexes.
L'activité clé de ce résultat est la conception, le développement, la mise en place et l'opérationnalisation des outils et plans susmentionnés (BD LUP, PRUSCB).

- Collecter, organiser et entreposer dans une base de donnée géospatiale les couches d'informations thématiques de sources externes (services internationaux et nationaux) au projet identifiées dans les requis du système
- Avec l'aide de l'expert en biodiversité réaliser les couches de données géospatiales synthétiques nécessaires pour réaliser le PRUSCB
- Réaliser le PRUSCB à l'échelle de la région avec l'aide de l'expert en biodiversité et l'implémenter sous forme de couche d'information géospatiale
- Mettre en place l'architecture technique du BDLUP
- Utiliser des technologies Open Source pour le développement du Système d'Information BDLUP selon les requis techniques et fonctionnels
- Arrimer le BDLUP, la géorépertoire et la voûte documentaire dans un portail WEB
- Transférer les connaissances, les technologies et participer au renforcement des capacités locales

Compétences

- Analyse en systèmes d'Information
- Développement de systèmes WebGis avec des technologies OpenSource
- Intégrations de technologies
- Traitement d'images, cartographie et intégration de données
- Une bonne connaissance générale en matière d'environnement, et développement durable et conservation

Profil requis
Éducation :

- Un diplôme universitaire (Master minimum) spécialisé en SIG
- Des fortes compétences en programmation

Expérience :

- Au moins 5 ans en tant que professionnel des SIG
- Des expériences éprouvées en termes de programmation WebGis de préférence

- A démontré sa capacité en termes d'autonomie, d'adaptation à des contextes nouveaux
- A démontré sa capacité à travailler dans un contexte multidisciplinaire et être proactif dans la recherche d'information

Langues :

- Français et Anglais parlés et écrits

Table 10: SO1 TT, Summary of METT assessments for 4 PAs

Key data from METT assessments						
	METT score	METT score %	Date of PA establishment	Area in ha	IUCN Category	Management Authority
Mikea	72	71%	06-Nov-2011	184,630	II	Madagascar National Parks
Onilahy	74	73%	27-Jan-2007	102,179	V	Co-management, assisted by WWF
BezMaha	71	70%	04-Jun-1986	4,200	IV	Madagascar National Parks
Tsimana	82	80%	10-Apr-1905	203,740	II	Madagascar National Parks

Table 11: SO1 TT's Assessment Form with key METT questions displaying low scores

The 30 Key METT Questions *(bonus questions excluded – max score per question =3; counting only the low scores <2)*	**Mikea**	**Onilahy**	**BezMaha**	**Tsimana**
1. Legal status				
2. PA regulations				
3. Law Enforcement .	0			
4. PA objectives				
5. PA design			1	
6. PA boundary demarcation				
7. Mgt plan				
8. Regular work plan				
9. Resource inventory				
10. Protection systems				
11. Research	1			
12. Resource mgt				
13. Staff numbers	1			
14. Staff training			1	
15. Current budget				
16. Security of budget		1		
17. Management of budget		1		
18. Equipment		1	1	
19. Maintenance of equipment			1	
20. Education and awareness				
21. Planning for land and water use				
22. State and commercial neighbors		1		
23. Indigenous people				1
24. Local communities				
25. Economic benefit		1		
26. Monitoring and evaluation				
27. Visitor facilities	1	1	1	
28. Commercial tourism operators	1	0	1	
29. Fees	1	0	1	
30. Condition of values				
TOTAL SCORES below 2: sum = 19	**5**	**6**	**7**	**1**

Annex 4: Incremental Cost Reasoning

Table 12: Baseline Alternative and Benefits of the GEF Project

Current Baseline	*Alternative*	*Global Biodiversity benefits*
In the business-as-usual (BAU) scenario, deforestation and forest	With the project, Madagascar will implement concrete measures for	The highly threatened dry deciduous forest and spiny thickets totalling 2.4 million ha

Current Baseline	*Alternative*	*Global Biodiversity benefits*
degradation trends experienced at the Atsimo Andrefana Spiny and Dry Forest Landscape will continue and likely accelerate. Forest patches will become further fragmented. Species that are forest-dependent will be increasingly threatened and may even become locally extinct. The existing threats to biodiversity from subsistence activities will be compounded by threats associated with large scale development: road opening, irrigation schemes, oil & gas developments and mining activities. Large scale projects will rapidly establish themselves in the region, bringing significant investments that are bound to transform landscapes and lead to biodiversity loss. There will be little if any investment in conservation, and any environment safeguards that may apply will be weak from a biodiversity perspective. At the landscape level, the "development accelerator effect" will add to the pressures, as increased economic activities will attract migrants. There will be more demand for firewood, charcoal, land and water resources. This will in turn exacerbate deforestation and forest degradation.	conserving, sustainably using and safeguarding biodiversity in the Atsimo Andrefana Landscape covering three contiguous districts (Morombe, Tuléar II and Betioki). In terms of response to the current, and emerging threats to biodiversity, the project promotes a paradigm shift from site based work to a landscape approach. The project will develop a collaborative governance framework for sectoral biodiversity mainstreaming involving public, private, CSO and CBO actors. Biodiversity considerations will be integrated into the development of economically relevant sectors across the landscape, in particular agriculture, forestry, extractive industries, energy production and transport, but also in the livelihoods and land use patterns of local communities. A two-pronged approach will apply. First, it will strengthen resource use governance at the landscape level by developing and implementing the BD LUP. It will work with national and sub-national level stakeholders to engage economic sectors, and negotiate the application of biodiversity conservation and sustainable use measures, and bring about necessary policy change. Second, the project will work with local communities to strengthen conservation on communal lands by establishing and managing multi use CCAs. It will put in place measures to ensure the sustainable utilisation of wild resources and conservation-friendly farming through a focused sustainable livelihoods and capacity building programme.	will enjoy increased conservation security and, at the wider landscape level, biological resources will be used more sustainably and essential ecosystem services maintained. Adverse land-use change will be stabilised in the fringes of core PAs (existing and new terrestrial PAs sum 240,000ha), thereby reducing the level of threats to biodiversity in PAs that emanates from their periphery. Forest fragments and extensive areas of high biodiversity value outside PAs (minimal estimated surface is 100,000 ha) will be brought under conservation management and will function as connectivity corridors. Threatened species found within the landscape will enjoy improved chances of survival among them emblematic species of lemur (*Propithecus verreauxi*, *Lemur catta* and *Cheirogaleus medius*), red-listed birds (*Monias benschi* and *Uratelornis chimaera* among others), as well as reptiles and amphibians (e.g. *Furcifer antimena* and *Ptychadena mascareniensis*). The current and emerging negative impacts on biodiversity from production sectors will be more effectively avoided, and managed at the landscape level, in particular within the agriculture, forestry, extractive industries, energy production and transport sectors.

Annex 5: Context and analysis behind the project justification

This annex contains details and analysis on:

A) The Consequences of the political crisis

The country is currently recovering from a long political crisis that started in 2009, after the democratically elected President was ousted by the opposition with support from the army. The free and peaceful presidential and parliamentary elections held in December 2013, with the support of the international community, were a milestone in the restoration of democratic institutions.

The five years of political transition and withdrawal of international aid have halted the development of the country and caused generalized institutional decline. Nevertheless, the return to rule of law and democratic institutions following the 2013 elections have given revived hope of improvements on several fronts of development.

The political crisis had a flagrant negative impact on the economy, and ultimately also on the management of its biodiversity and ecosystems. The country's economic growth has been negative as shown by a rate of -4% in 2009, when the conflict broke out. With a population growth rate of 2.8%, massive reduction of development assistance, recurrent external shocks, lack of effective natural resource management, and low income rates, the social impact has even been greater. The extremely low growth rate, in the range of 1.5% on average during the period running from 2010 to 2013, failure to provide vulnerable groups with generalized access to basic social services, income generation, or jobs, extreme poverty and social, economic, and regional disparities were exacerbated.

Provision of social services, such as health and education, are heavily dependent on external aid. Where public institutions were already structurally weak, the crisis aggravated the difficulties they faced to deliver public services. Although the impact on conservation has not yet been fully assessed in monetary terms, there was a huge tendency to pull out investment gravely affecting PAs and sustainable environment land-uses.

Moreover, regarding investments in general, uncertainty still remains. According to the ranking conducted by Transparency International, Madagascar occupies number 127th out of 177 countries (2013) and according to the Mo Ibrahim Index, Madagascar is the African country where governance has shown the sharpest downfall, with its score decreasing from 57.5 out of 100 in 2000 to 45.7 in 2012.

Although the context in the past years was not favourable to investments, requests for lands for agribusiness development purposes were maintained and some permits were delivered to foreign companies. Official figures are however not available.

In the same way, emerging industries of the oil and gas sectors, as well as industrial mining are expected to develop rapidly. The government and many hopeful citizens see this as a game changer for Madagascar with respect to economic growth and improved social wellbeing It is estimated that the mining sector currently generates approximately 15% of the GDP against less than 1% in 2010.[46]

Although oil and gas developments are still at the exploration phase, and several mining project could take years to be fully blown productive and profitable, the launching of one or two extractives projects could be sufficient to trigger an economic boom.

What really could be a veritable 'game changer' for Madagascar is how manages its new extractives' boom – reason why this project is timely and relevant.

B) Natural assets and recent trends in NRM

Madagascar constitutes one of the world's most important storehouses of biodiversity (see e.g. PRODOC paragraph 11). To date, the natural endowment of Madagascar is the first line of economic resources used by its population, constituting 49% of the country's total wealth. This estimate includes the value of: (i) Forest areas that produce timber (lumber and firewood), non-timber forest products, and bioprospecting values; (ii) Protected Areas; (iii) Agricultural land, including farmland and pastureland; and (iv) Fishing. The value of ecosystem services - especially in terms of water and income from tourism - is included in the value of Protected Areas and agricultural land.[47]

Biodiversity offers advantages in the form of ecosystem services; it regulates the flow of water, reduces floods and risks of water shortages. These benefits are also essential to urban water users and hydropower production. It is estimated that PAs provide water services to at least 430,000 hectares of irrigated perimeters and potable water to 17 major towns.[48]

Given the current levels of degradation, as it will be presented further down, the question is how to translate Madagascar's natural assets into equitable benefits and, ultimately, welfare for the Malgasy population, without further aggravating the environmental crisis.

Ecotourism

The stunning landscapes offered by the country's terrestrial and marine ecosystems are the main assets of the Malagasy tourist sector. It is estimated that 70% of the tourists who come to Madagascar visit at least one Protected Area.

Before the crisis, the tourism industry, which largely relied on Madagascar's worldwide famed biodiversity, was estimated to generate USD 500 million per year, with an average annual growth rate of 10%. An important source of foreign currency revenues (6% of the GDP in 2007), this sector also accounts for more than 200,000 jobs (5% of the total number of jobs), especially in remote rural areas, benefiting the most vulnerable segments of population. However, with 200,000 visitors in 2012, the tourism industry in Madagascar remains weak compared to the millions of tourists that the neighbouring island of Mauritius welcomes every year.

The current boom pushed by the mining sector

For years, the country prepared for a new era in the mining sector by equipping itself with legal and institutional tools that promote direct foreign investments in this sector. The stock of foreign direct investments (FDIs) in the extractive sector (mainly mining) went from MGA 47 billion in 2005 to nearly MGA 5,800 billion (75% of the total FDIs) in 2009.[49] This extremely rapid growth is largely due to the launching of two mining projects of global scope: the ilmenite mine (titanium ore) of QMM/Rio Tinto in the region of Anosy (southeast) that entered the production phase in March

46 Banque Mondiale (2010) Opportunités et défis pour une croissance inclusive et resilitente, Ch, 8 Le secteur minier
47 Country Environmental Assessment (CEA), World Bank (2013)
48 Ibid.
49 Les Amis de la Terre, France. Synthesis, November 2012. Madagascar : nouvel eldorado des compagnies minières et pétrolières.

2009 with an initial investment of nearly USD 1 billion[50]; and the Ambatovy project for nickel-cobalt mining in the east of the country with an investment estimated at USD 5.5 billion.[51] The consortium led by the Canadian company Sherritt received a temporary exploitation permit in September 2012.

In spite of the "boom" that occurred over the 2005-2008 period, mining operations deteriorated and the country's attractiveness decreased as a result of the international financial crisis, combined with the national political crisis.[52] Although more than 4,000 permits were valid in 2008 (regardless of the type), in 2009 issuing permits reached a standstill, and forced numerous operators to work informally as shown by the trend in the number of regular permits.

To attract large-scale FDIs such as those from the large-scale extractive sector, recent governments have set up an enabling institutional and legal framework. Passed by parliament in 2002, the current Mining Code provides for the adoption of a specific legal framework for large-scale mining investments and a preferential tax system for mining projects exceeding a certain investment threshold.[53] The investment threshold was decreased from USD 100 to 25 million in 2005 to attract new investors.

The past governments of Madagascar have all placed mining at the heart of their strategic vision for development. Although mining has always had an important role to play (gold mining and gem stones mainly), the recent launching of the QMM and Ambatovy megaprojects denote a clear change in scale. They are a turning point in the country's development model.

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The stock of foreign direct investments (FDIs) in the extractive sector (mainly mining) went from MGA 47 billion in 2005 to nearly MGA 5,800 billion (75% of the total FDIs) in 2009.[55] This extremely rapid growth is largely due to the launching of two mining projects of global scope: the ilmenite mine (titanium ore) of QMM/Rio Tinto in the region of Anosy (southeast) that entered the production phase in March 2009 with an initial investment of nearly USD 1 billion[56]; and the Ambatovy project for nickel-cobalt mining in the east of the country with an investment estimated at USD 5.5 billion.[57] The consortium led by the Canadian company Sherritt received a temporary exploitation permit in September 2012.

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Like large-scale mining companies, small-scale or artisanal mines have a facilitated access to exploration and mining permits.

In the government's view, the development of the extractive sector and associated infrastructures could become an important source of income for the country and contribute to poverty reduction.

However, there are countless illegal operations that still take place, that pose a real threat to biodiversity: risk of increasing pollution as a result of pollutant release during extraction, destruction of natural habitats, and exposure of workers to occupational hazards.

In spite of the benefits that the country and Region hope to receive through mining operations, this does not rule out the need to assess the negative impacts biodiversity and ecosystem functions and processes, since the value of the profits generated from the extractive industry investment projects may in turn affect the value of the Madagascar's natural capital resulting in a net negative economic balance.[60]

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[50] Sustainabile Development : Report 2011, Rio Tinto/QIT Madagascar Minerals SA, www.riotintomadagascar.com/pdf/RDD_2011_FR.pdf
[51] Rapport de développement durable 2010, Ambatovy.
[52] World Bank. 2014.
[53] Refer to section 1.2.3 Environmental Management in Madagascar and to Annex 5-F for a brief analysis of the legal context of the mining sector.
[54] In Madagascar, an in-depth revision of extractive sector legislation was conducted in the 1990's leading to new policies. These policies were operationalised by adopting a new oil code in 1996 (Law n°96-018), a new mining code in 1999 (Law n°99022)13 and institutionalizing a special regime for large scale mining projects in 2002 (Law n°2001-031 on large scale mining investments – LGIM).
[55] Les Amis de la Terre, France (2012).
[56] Sustainabile Development: Report 2011, Rio Tinto/QIT Madagascar Minerals SA, www.riotintomadagascar.com/pdf/RDD_2011_FR.pdf
[57] Rapport de développement durable 2010, Ambatovy.
[58] World Bank. 2014.
[59] Refer to Legal and Institutional Framework section 1.5 for a brief analysis of the legal context of the mining sector.
[60] Country Environmental Assessment (CEA), Banque Mondiale (2013).

Box 4: Ecological impacts of oil, gas and mining investments in Madagascar (quoted content in French from a 2013 WB report)

Empreinte écologique des investissements miniers à Madagascar

A Moramanga, entre Antananarivo et Toamasina, la compagnie **Sherritt International, basée au Canada,** prévoit d'extraire 60.000 tonnes de nickel et 5.600 tonnes de cobalt par an pendant 30 ans avec le projet Ambatovy, déjà en phase d'exploitation. La boue chargée de minerai est extraite de la mine à ciel ouvert, envoyée par pipeline à Tamatave où une usine effectue la séparation avant de stocker les déchets, d'abord à terre puis à terme en mer, après basification des boues acides (qui devraient être basifiées par du calcaire en provenance de Tuléar).

Le travail de la mine consiste à enlever la végétation, une forêt littorale pour l'essentiel, séparer mécaniquement et électriquement dans un lac artificiel le minerai du sable puis à reposer le sable débarrassé de son minerai, et enfin à revégétaliser ce sable débarrassé de son minerai.

À Fort Dauphin, dans le sud-ouest du pays, la compagnie **anglo-canadienne Rio Tinto**, géant mondial du secteur minier, prévoit de produire 750.000 tonnes d'ilménite par an au cours des 60 prochaines années (actuellement en phase d'exploitation).

L'investissement pétrolier, de la **compagnie française Total**, est en cours et à venir. Sur la côte ouest, à Bemolanga et Tsimiroro, Total pense exploiter des schistes bitumineux. Il s'agit d'un bitume très visqueux aggloméré à des schistes et à du sable, duquel on peut faire du pétrole. Les deux gisements sont estimés à 6 milliards de barils. Le processus d'extraction consisterait à chauffer le bitume en injectant de la vapeur et des solvants en profondeur puis à mélanger le sable extrait avec de l'eau chaude pour le rendre moins visqueux avant de laisser décanter pour extraire le pétrole.

Ces trois projets miniers ont **détruit ou détruiront des forêts** (600 ha pour Sherritt, 4.000 ha pour Rio Tinto, aucune pour Total, qui exploitera le gisement dans une région déboisée) et plus généralement des **espaces naturels** pour extraire le minerai ou les hydrocarbures.

Elles se révèlent également polluantes : très peu dans le cas de l'ilménite, bien plus pour l'exploitation du nickel, qui produit des boues acides, et peut-être plus encore pour l'exploitation des sables bitumineux, qui nécessite de grandes quantités d'eau dans une région désertique, stérilise les sols et produit d'immenses lacs de déchets miniers.

Les trois projets entraînent la **construction de nouvelles infrastructures** qui ont elles aussi une empreinte écologique : le port minéralier d'Ehoala, le pipeline qui amène les boues de Moramanga à Tamatave et qui traverse un corridor de forêts denses humides, et les probables infrastructures qui seront associées à l'exportation de pétrole dans le cadre du projet d'exploitation des schistes bitumineux.

Country Environmental Analyses, CEA, World Bank, 2013

C) The regional development context

Key regional data

According to official estimates, in the Atsimo Andrefana Region the intervention area, 82.1% of the population lives under the poverty line.[61] It was 76,2% in 2005 according to the IMF[62] (i.e. before the crisis). The rate of poverty prevalence the region is above the national average by a good 10 percent points. Rural areas are proportionately poorer than urban centres (87.4% and 65.9% respectively).

Education levels are low: just a little under one third of the population has attended at least primary school (52% at the national level). The birth rate is extremely high, with women having 6.2 children on average. Considering this number, the region's population is expected to double within the next 20 years. The population growth in the town of Toliara is significant: from 120,000 to 172,000 inhabitants from 2007 to 2010). This boom also translates into a strong demand for fuel wood. The annual fuel wood consumption per capita in the town of Toliara is estimated at approximately 150Kg

[61] Monographie Région Atsimo Andrefana, CREAM (2013). Statistics in this section are from the same source, unless otherwise stated.
[62] International Monetary Fund, 2006. Republic of Madagascar: Poverty Reduction Strategy Paper Annual Progress Report. IMF Country Report No. 06/303.

of charcoal, against 100Kg in other regions.[63] Three quarters of the Region's communes are not connected to the power network and more than half of them do not have running water.

Due to high demands on natural resources, coupled with unsustainable agricultural practices, the natural forest cover of in Atsimo Andrefana is rapidly degrading. Indeed, its forest formations are especially vulnerable to any form of extraction, as their constituent natural species are slow to regenerate.

The economy of the Atsimo Andrefana Region is dominated by the primary sector and is concentrated on agricultural, fishing, and livestock farming activities. These activities are the source of income of 80 to 95% of the heads of household.[64] Part of the production is intended for sale, as shown by the existence of marketing infrastructures in the communes and numerous regular markets.

The region has undergone a process of negative industrialization over the past years. However, it is still home to a few industrial activities, including textile and garment manufacturing (24% of these activities). Still, in 2008, only 2% of the companies and businesses created in Madagascar over that year were located in the Atsimo Andrefana Region.

In 2009, mining activities of different types were practiced in nearly two thirds of the communes in the region. The map of mining indexes of the Ministry of Mining and Hydrocarbons shows that the area abounds with numerous and varied mining resources.

Lastly, with stunning landscapes and harbouring globally emblematic species (see e.g. **Figure 1** and**Figure 2**) the Region has a very high tourist potential, especially with foreign visitors with the capacity of hotels to accommodate tourists quadrupling over the past decade.

Atsimo Andrefana, a region with economic growth potential

298. Atsimo Andrefana is among one of the 12 economic growth areas identified within the NDP. The NDP states that within the Region "the opportunities for mining investments and related impacts on the development of the region and municipalities is considerable"[65]. If the principles of inclusive and sustainable development are applied in the implementation of development plans and policies, the National Outline for Land-Use Planning Guidelines must, according to the NDP, "allow those responsible for economic, budget and sector planning, to consider the spatial dimension of development and establish coherent policies, enabling to increase the impacts of collective efforts".

299. The main challenge for the Region of Atsimo Andrefana is to reconcile sector guidelines that are not compatible. In this manner, the NDP recognizes that the geographic conditions of Madagascar make it abundant in minerals, oil and gas. Meanwhile, the NDP also made a clear reference on the need to make development compatible with conservation efforts through *"participatory conservation, systematic restoration, rational use of natural resources, and rational exploitation"* regarding the use of biological resources, which are considered a very important asset for the country:

> *"Mining activities [...] are among the top three causes of deforestation and forest degradation in Madagascar as the conflict with the network of protected areas, its impact on the lives of biodiversity and natural habitat functions, pollution of water and soil resources, and the effects of induced development. [...] It is crucial that mining activities mitigate the risks and threats, and contribute effectively to development opportunities. [...] The current growth of the sector has not been inclusive, sustainable, nor equitable. "*

Biodiversity of global significance in Atsimo Andrefana

The target landscape of the project is home to unique biodiversity of global importance. It has a sub-arid climate and is characterized by dry and spiny forest vegetation which can be divided in two ecoregions: the dry forest ecoregion of Madagascar in the western and northernmost parts of the country, which is the only African tropical region with dry deciduous forest to be listed on the WWF Global 200 as endemic and highly vulnerable; and the spiny dry forest ecoregion along the western coast, extending from the Mangoky river, in the north, to the mountains of Anosy, in the south, and providing separation from the rainforest of Eastern Madagascar.

The two ecoregions are home to various and distinctive vegetation types, adapted to the weather and ecological conditions as well as the geographic situation. They are home to a diversity of habitats. The most frequent one is the

[63] Réglementation de la filière bois énergie dans la Région Atsimo Andrefana, WWF (2012)
[64] Tableau de Bord Environnemental, ONE, 2007.
[65] Ministry of Economy and Planning: National Development Plan - 2015-2019.

xerophytic thicket of the Southwest in contact with the dry dense forest whose borders remain unclear whenever soil and climate conditions are similar, resulting in a diversity of plant formations of transitional type.[66]

However, in spite of these natural barriers, the pressures that were previously overlooked or underestimated now constitute an imminent danger for biodiversity. Since the beginning of the 1980s, the ecoregion has been undergoing an unprecedented ecological crisis that translates into intense deforestation on the outskirts of large towns such as Toliara, around small urban centers highly subject to rural change (Morombe, Betioky, etc.), and in rural areas[67]. As a result of the collapse of rural economies following cyclic droughts, drop in agricultural production, and price decrease of cattle, rural households find themselves suffering high levels of insecurity. Due to increasing demographic pressures associated with the inflow of migrants seeking work or farmland, the demand for forest products has steeply increased in both urban, and rural areas. This has triggered a spiral of unsustainable natural resource use and changes in the ecoregion and main ecosystem processes.

Fig3

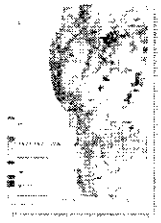

Fig4

Click here to access images

Figure 3: Map of Protected Areas in the study area (SAPM 2013)

Figure 4: Map of ecosystems in the study area (Landsat Classification December 8, 2014, Hansen Global Forest cover, Atlas of the Rebioma vegetation 2008)

These threats have aggravated deforestation, altered lower valleys, and transformed forests as slash-and burn farming and charcoal production gradually encroach on areas which were previously protected by their remote location, removing natural protective barriers.

In recent years, this situation has been exacerbated by the new large-scale investments in the mining and agricultural sectors compounded with existing artisanal mining operations.

Migration

According to the settlement history of the region,[68] the territorial distribution of ethnic groups is well delineated although some overlapping and cultural mixing occur. For instance, the coastal area is settled by the Vezo.

The Mahafaly plateau and area of Amoron'i Onilahy is occupied by the Tagnalana, Mahafaly, and Antanosy.

The Masikoro plateau and Mikea forest[69] are home to five ethnic groups: the Masikoro and Vezo, who are the most numerous, and the Mahafaly, Antandroy, and Sakalava.[70] Masikoros are highly nomadic crop and livestock farmers, while Vezo's are nomadic fishers who do not own land.

Mikeas have highly specific characteristics that make them a very distinctive group. Mikeas are former Masikoro crop and livestock farmers or Vezo fishers who, towards the 17th century, sought refuge in the dry and spiny forest extending between Morombe and Toliara.[71] Until the 1970s, the lifestyle of the Mikea people was closely bound to the forest and they used its resources in a sustainable way, in accordance with their cultural identity.

Other minority ethnic groups, such as the Antandroy, Bara, Betsileo, Merina, and Indian-Pakistani have migrated to the region over the centuries. They generally are tradespeople, civil servants, carriers, or farmers looking for farmland.

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[66] ONE (2007).
[67] Une vision de la biodiversité de la région écologique des forêts d'épineux, WWF (2000).
[68] *Plans Communaux de Développement*, 2005. The communal development plans were developed with support by NGO's such as WWF, and by MNP and GIZ.
[69] Dina, J., Hoerner, J. M., 1976. Étude sur les populations Mikea du Sud-Ouest de Madagascar.
[70] Tolojanahary, J., Etude des impacts environnementaux des travaux d'aménagement de la Route nationale 9 sur la forêt Mikea, Ecole supérieure polytechnique d'Antananarivo (Madagascar), UFR Sciences Economiques et de Gestion de Bordeaux IV 2012.
[71] Rengoky Z., Les Mikea : chasseurs, cueilleurs à Analabo, Mémoire de Maîtrise en Anthropologie. Université de Tuléar, 1998.

D) Emerging sectors: mining, oil, and large scale commercial agriculture

Extractives and associated infrastructural development

The subsoil of the Atsimo Andrefana Region contains soils rich in mining resources that duly attracts large-scale investors. Each mining request is assessed and permits are granted and processed independently form other mining project. As a result, there is no consideration of the spatial planning of the landscape. Yet, changes in the profile of the landscape requires spatial planning in time and space in order to integrate the right balance between development and conservation and enable to design land-use plans that strike a balance between the right mitigation measures and trade-offs. As mentioned at the national level, the latter is required for Regional land-use planning.

The Government intends to use mining resources as the pillar of the country's development. This sector has significantly developed since last decade attracting numerous national and international investors. Two types of development scales exist: small-scale mines with a limited surface area and resources and large-scale industrial mining operations.

Mining operations permit of different kinds and durations have been issued on lands located in the target landscape. A clear map identifying the areas where permits were issued is still lacking.[72] Three quarters (3/4) of the permits issued were granted to small mines, including 70% for gold and precious stone mining (WWF). However, they generate only 2% of the revenues paid by extractive industries.[73]

There are three large terrestrial oil blocks currently under the exploration phase and that belong to ESSAR Energy Holding (block 3110), Madagascar Southern Petroleum Company (block 3112), and Petromad (block 3114), overlap with the Atsimo Andrefana landscape as a whole. Several off-shore blocks of smaller size have also been granted. For the time being, none of these oil blocks have entered the production phase, however, terrestrial exploration activities are underway and progressing rapidly. Although they are located outside of the target landscape perimeters, oil reserves and gas reserves to exist in the Beza commune (Betioky district) and the town of Sakaraha respectively. The oil and gas concessions frequently change owners.

Mineral ores also attract numerous investors. In the Region, several of them have already led to major exploration works. Subject to the results of feasibility studies, some may move to the exploitation phase in the medium term, namely the ilmenite ore in the Ranobe area, close to Toliara, by the company Toliara Sands; and the coal of Sakoa which is simultaneously mined by two companies, namely Madagascar Consolidated Mining S.A. (MCM) and Pan African Mining Sakoa Coal S.A. (PAM Sakoa).

The Region holds the highest number of environmental permits granted to companies in the country. From 2004 to 2010, seventy-five (75) permits were granted to projects to be implemented in this region. Four out of the thirty-seven environmental permits delivered by ONE in 2010 (including 14 for the mining sector) were located in the Atsimo Andrefana Region.[74]

Land use planning in the Region has historically been subject to conflicts between sectors. Mining exploration permits have been granted in areas identified as key biodiversity areas, destined for conservation purposes. This has created insecurity among environmental operators, as well as for land and natural resource management by communities.

Since 2003, according to WWF, applications for mining exploration permits have been increasing, especially in the limestone sector. Although settled in the East, Ambatovy SA (Sherritt) intends to extract limestone in the area of Toliara (Soalara) for the processing of mineral ore and by-products at the Toamasina plant. Other investors (Magrama, Jindal, and small operators) are in the middle of conducting studies, exploration, and development campaigns for limestone exploitation.[75]

WWF has warned about the threat that granting permits on lands bordering PAs and other located within PAs may represent for biodiversity. Currently, mining blocks are located bordering or encroaching on the NPA of Amoron'i Onilahy, KP 32 Ranobe, NP of Tsimanampesotse, Itampolo, and others, as well as in some community areas managed under management transfer contracts.[76]

World Titanium Resources for instance holds exploration permits over 2,000 mining blocks in the Communes of Tsianisiha and Ankilimalinika; one ilmenite and zircon development pilot project was set up in 2006 and a feasibility study was conducted. The upper valley of the Manombo River is also included in the mining blocks and is owned by Madagascar Exploitation.[77]

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72 Mining activities mentioned in this section are mainly terrestrial, even if they have indirect negative consequences on coastal and marine areas.

[73] Etat des lieux du secteur mine à Madagascar, WWF (2012).

[74] ONE (2015).

[75] Rapport d'étude sur l'état des lieux du secteur mine de Madagascar, WWF (2012).

[76] Etat des lieux du secteur mine de Madagascar, WWF (2014). This document is a contribution by MWIOPO to the assessment made to diagnose the state of the extractive industries in Madagascar.

[77] This valley is very important for biodiversity conservation, and negotiations have taken place between WWF and the company to take discuss suspending the classification and taking away the permit issued to the company for this area, based on a voluntarily agreement with the company (WWF Réf).

The company Toliara Sands (TS SARL) holds the ore in the Ranobe area on which over 20 million dollars have been spent on exploration and impact assessments since its discovery in 1999.

The company Madagascar Resources (MR Sarl.) has expanded its mining permits to the Manombo-Morombe area (Ankililoaka, Baibasy, and Ankarefo). Additional drillings were made in 2000, 2001, and 2003. A complementary drilling was made in 2012 (source of information: Toliara Sands document).

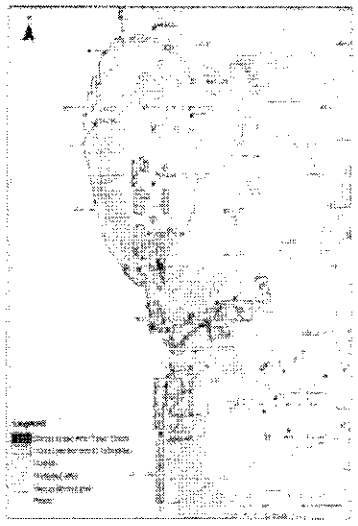

Figure 5: Main mining exploitation permits in the study area

Click here to access images

Box 5: Mining operations in the Project Zone

World Titanium Resources has four exploration targets which comprise the Toliara Sands Exploration Project. These include Ranobe, Ankililoaka, Basibasy and Morombe.

Morombe

Exploration work to date indicates that the "Big Dune" area at Morombe contains higher TiO2 ilmenite as well higher zircon grades than Ranobe. The area has abundant water which would allow a dredging operation. The ultimate potential seen is for a large-scale operation which could support the infrastructure capital required to export a product through a port created at Morombe.

A drilling program is planned for 2012 with several lines across the area following up earlier reconnaissance hand auger sampling results. The aim is to clarify the stratigraphy of the area, collect samples of heavy minerals (HM) for further analysis and determine the potential for economic mineralization.

Ankililoaka

At Ankililoaka, 25km north of Ranobe, drilling encountered intersections over a distance of 5000m, in young quartz sands and clay sands, to both the north and south of a northwest trending ridge of limestone. Based on the drilling, the exploration target at Ankililoaka is 360-368 million tons containing 5 – 6% THM and 8.5 – 9.5% Slimes. The heavy mineral suite is similar to Ranobe and is dominated by ilmenite (52%), leucoxene (5%), rutile (1%) and zircon (4%) with the TiO2 content of the ilmenite ranging from 47.6 to 56.8% TiO2.

Basibasy

At Basibasy, 60km north of Ranobe, there appears to be a shoreline running roughly through north- south, with clay-rich sediments to the east. West of this "shoreline" the sediments are more sandy and drilling encountered significant mineralization (i.e. 39m at 7.0% HM) in quartz sands in an area around 2km by 3km. The Exploration Target based on this drilling is around 440-446 million tons containing about 4.5%- 5.5 THM and 8 – 9% Slimes. The heavy mineral suite is dominated by ilmenite (50%), leucoxene (16%), rutile (1%) and zircon (7%) with the TiO2 content of the ilmenite ranging from 50.2 to 59.6% TiO2 and therefore appears to be different to that at Ranobe.

Source: http://www.worldtitaniumresources.com/toliara-sands-exploration/

Large scale commercial agriculture

Rain-fed farming, which essentially relies on the hot seasonal rainfall, is the most common form of agriculture. Flood recession agriculture, called *baiboho*, is the oldest form of agriculture practiced and is exclusively limited to the valleys of permanent rivers. WWF currently notes that the swamps of the Ranobe Lake are gradually being converted into rice fields by residents.

Nevertheless, irrigated farming is both the most speculative and most recent form of farming. Irrigated perimeters are rather numerous but their surface area is extremely limited. They essentially occur around a few rivers: Mangoky, Manombo, Fiherenana, and Onilahy.

Large-scale irrigated farming, practiced on private properties, for commercial exports is new in Madagascar. Consequently, there is little experience in environmental impact management at the landscape scale, although request for commercial land-use and production of various crops (maize, Lima bean, but also jatropha or cassava) are piling up.

In the Atsimo Andrefana Region, the Region is providing support for local development, such as infrastructure development, leading to accelerated growth of agribusiness, tourism, and other value chains, especially along National Road 9 leading to Morombe.

The Ministry of Agriculture is currently conducting two large projects, with funding from AfDB. The Lower Mangoky Rehabilitation Project (LMRP) consists in rehabilitating the Bevoay intake in the Lower Mangoky. This project has already allowed to irrigate 5,000 Ha of rice fields. Currently in its second phase, it will irrigate an additional 5,000Ha. Additionally, the Project to Rehabilitate Agricultural Infrastructures in the Southwest (PRAIS) aims to irrigate 13,000Ha of agricultural land mainly for rice, lima bean, and maize farming. Aside from the construction of these infrastructures,

these projects also comprise agricultural research and development components. The World Bank, through the IG2P 2 is working on the development and organization of a few agricultural subsectors along NR9 and NR7.

Since 2010, a cotton project was initiated after the purchase of a cotton plantation by Haysa, a company of French origin settled locally since the 1950s. With WCS as the conservation partner, the project aims to set up production methods that are compatible with conservation.

Four other big operators are present in the Region: DRAMCO, Malagasy Standard Group (MSG), ChiMad Coton (CMC), and INDOSUMA. Contracting out directly with small producers, they offer farmers, faced with decreasing soil fertility for their own subsistence crops, new farming opportunities.

Bionexx, a large-scale company, has approximately 2,000 employees in the Ankililoaka area for 1,450Ha farmed land.

Recently, the Chinese company Tian Li Agri also settled in the region. Other Chinese companies are also looking for production opportunities around the town of Toliara.

E) Threats to and impacts to biodiversity specific to the target landscape

The profile of threats on the biodiversity in the Atsimo Andrefana Region, which is home to unique ecosystems and a huge wealth of rare species, is identical to the one on the country's biodiversity in general.

Land use changes and habitat loss

As in the rest of the country, deforestation is one of the major problems that the target landscape faces. It poses threats to biodiversity as it involves habitat loss and over exploitation of natural resources. These two phenomena traditionally occur because land is cleared for subsistence agriculture. Different factors account for the search for new farm lands.

Fig6

Fig7

Click here to access images

Figure 6: Map of the deforestation of the study area 2000 - 2013 (Hansen GFC2014)

Figure 7: Deforestation to the east of Mikea (Hansen GFC2014)

The late 1980s saw a boom for commercial maize production and marketing in the region of Toliara.[78] The progression of the agriculture frontier of maize that led to increased deforestation, was mainly done through slash-and-burn farming techniques, locally called *hatsake*. This pioneer agriculture developed rapidly as a result of several factors: increased demographic pressures due to the inflow of migrants, saturation of fertile soils, and slack controls of forest.[79]

The soils of the region are extremely poor in nutrients and within two or three farming cycles, become depleted. When land becomes sterile, farmers are forced to leave the exposed surfaces to clear new land, moving closer each time to biodiversity rich forests which still remain intact. From 1993 to 2005, deforestation has caused the loss of 217,165Ha, i.e. 18,097Ha/year or an annual average deforestation rate of 0.82%.[80] This loss of forest has increased over the past decade. According to measurements by the WCS-ONE-MNP-ETC-Terra Consortium, the deforestation rate in the Atsimo Andrefana region amounted to 2.06% from 2005 and 2010 and 2.80% from 2010 to 2013 (PERR FH, 2014).

The Mikea forest, which a transition between dry and spiny forest ecosystems, is a blatant example of this, having lost 28% of its primary forest cover over the past three decades.[81] Moreover, it is estimated that the deforestation involves the disappearance of 75% of original plant species, some of which have a high economic value when used as construction wood or medicinal plants.[82]

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[78] Instabilité des cours du maïs et incertitude en milieu rural le cas de la déforestation dans la région de Tuléar Fauroux, S. (2000), in Tiers-Monde.
[79] Tableau de Bord Environnemental. Synthèse sur l'état de l'environnement de la Région Atsimo Andrefana, ONE (2007).
[80] Ibid.
[81] UNEP. Atlas de notre environnement en mutation: forêt Mikea (online, no date).
[82] Madagascar: La forêt en danger IRD (2000).

According to WWF, wetlands are endangered by the gradual conversion of the Ranobe Lake marshes into rice fields. Such conversion alters water quality and ecological processes of aquatic plants, and increases the vulnerability of several endemic bird species.

The situation is aggravated by the **high level of poverty**. Local communities adopt coping strategies that are environmentally unsustainable, faced with a lack of sustainable alternatives. It is also common for **migrants** to clear forest areas through slash-and-burn: **the different forest products are overexploited** and consumed in an unsustainable manner.

Pressures are generated by migrant populations, coming from the north-eastern area of Morombe following the NR9 to settle on the West, closer to the Mikea forest. Accrued pressures have also been observed in Betioky, upstream of the River Onilahy.

Charcoal markets are also an important factor of degradation of the region's forest. The larger part of the production targets the supply the town of Toliara. Fifty-three percent (53%) of charcoal comes from the areas along the NR9. Studies conducted by PARTAGE for WWF show that people currently tend to gradually replace fuel wood with charcoal, even in rural areas.[83]

According to a study conducted by the Environmental Program III in 2007, the annual consumption of fuel wood in the town of Toliara alone (firewood and charcoal) amounted to 288,782 metric tons equivalent of dry wood. All this fuel wood supply comes from illegal extraction from natural forests. Furthermore, according to this study, the potential for sustainable production of fuel wood by these natural forests now only amounts to 64,000 metric tons equivalent of dry wood. These figures confirm that the forests of the South West are rapidly degrading, including in PAs since the fuel wood consumption continues to increase.[84]

Charcoal production is even more harmful as it uses several tree species at the same time. Thirty-seven percent (37%) of charcoal producers are located around the year. For 35% of producers this activity represents their main source of income.

Considering the type of agriculture and especially the livestock farming techniques practiced locally, **bush fires** have become unavoidable. Dry and spiny forest areas are especially sensitive and slash-and-burn farming practices can easily cause uncontrolled and highly damaging fires. According to aerial surveys, the surface area burned in the Tsimanampesotse National Park was estimated at 20 hectares in November 2010, 52 hectares in November 2011, 39Ha in November 2012, and 33 hectares in December 2013.[85] In the KP 32 Ranobe New Protected Area, the surface area cleared amounted to 4,121 hectares in 2010 and 2,020 hectares in 2012.[86]

Loss of high value species

Endangered species such as the radiated tortoise *Astrochelys radiata* and the spider tortoise *Pyxis arachnoides,* which are found only in the southern and south-western ecoregions, are exposed to rapid degradation of their habitat (spiny thicket), in addition to being collected for local consumption and national and international trade.[87]

Emerging sectors: potential threats, examples

New risks of **pollution** have emerged over the past decades in relation to the emergence of a new economy relying on large-scale agriculture, mining and oil developments. These risks are related to the chemicals and wastes discharged on land and in water bodies/streams (sea, rivers, ground waters), i.e. pesticides, toxins, chemicals, etc.

Cotton is currently the most commonly farmed crop in the Atsimo Andrefana Region. It is one of the crops treated with DDT – as mentioned above. The relating risk of pollution is high and could affect water networks which are already scarce in some places of the region.

Since November 30, 1993, a ministerial order prohibits the use of DDT in agriculture. The same applies to POP pesticides (Dieldrine and Aldrine) which were used in cotton farming and are now prohibited by the same ministerial order. However, according to the studies conducted as part of the development of the implementation plan of the Stockholm Convention on POPs, some sites have been contaminated by POP pesticide residues in the Southern region of Madagascar.

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[83] Mise à jour de la stratégie ABETOL, Rapport final, PARTAGE (2011).
[84] Reboisement Bois Energie dans le Sud Ouest de Madagascar – Le bilan des trois campagnes. Synergie Energie Environnement dans le Sud Ouest, WWF (2011).
[85] Rapport d'analyse des photographies aériennes obliques de décembre 2014 dans le Parc National Tsimanampesotse par Aviation Sans Frontières Belgique, Andriamalala, F. (2015).
[86] Oblique aerial photography: A novel tool for the monitoring and participatory management of Protected Areas, Gardner, C., J. et al. (2015).
[87] Programme d'actions pour la conservation des tortues terrestres endémique du sud et sud-ouest de Madagascar Astrochelys radiata et Pyxis arachnoides, 2010-2015, WWF (2010).

In addition, maize farming substantially developed as the demand from neighbouring islands has increased. Due to failure to put in place an effective development and monitoring & coordination framework between the most concerned sectors (Agriculture, Forests, Land, etc.), this agriculture boom has strongly contributed to forest degradation.

These crops are still developing and others may add to the list. According to the Regional Directorate of Rural Development (DRDR), there are still other operators who are interested in investing in the region.

Fig8

Fig9

Click here to access images

Figure 8: Main sectors where agricultural practices are intensifying (Ankililoaka)

Figure 9: Main sectors where agricultural practices are gaining in intensity (Morombe)

These projects can also have damaging secondary impacts. The **opening of roads** will attract strong migration mostly of poverty stricken populations. The rehabilitation of NR9 by government-led local development projects (PIC II and PRBM) have provided access to several areas. Over the years, this could lead to **substantial inflow of migrants**. These additional impacts will exacerbate those of the initial footprint in that they will increase the **demand for water, wood, charcoal, and agricultural land**. This could also cause additional **poaching of endangered species**.

Impacts on biodiversity will be felt through the setting up of infrastructures when encroach on biodiversity rich sites to set up quarries, display construction materials, and opening access routes to transport their products. It has been observed that finding quarry sites suitable for road infrastructure construction in the region of Toliara is a difficult task.

An example is the case of KP 24 in the Commune of Maromiandra, where part of the Ranobe forests are being used by the CHINA Railway company - a provider of the Ministry of Public works - as a quarry for the rehabilitation of NR9.

As these emerging sectors are developing, it becomes increasingly important to conduct spatial planning at the landscape scale to strike a balance with sustainable and equitable development, in collaboration with all sectors.

As mentioned in previous chapters, in three cases of mining and oil investment projects, PAs as well as the ecosystem services that support conservation and provide socio-economic benefits to local communities, are seriously endangered by the loss of natural habitat.[88] Communities may have to leave the sites affected by pollution on soil, and water, and by forest degradation, hence the pressures on natural resources, PAs, and fragile ecosystems elsewhere will be exacerbated.

Climate change

According to the projections made for year 2055 the Southwest of Madagascar will be the part of the country most affected by **climate change**.[89] Fish, which is the most nutritious food of coastal communities, will become scarcer as the temperature of the sea rises and cyclones become more intense. Because they damage crops, cyclones will also drive farmers to move from the inland to the coasts, which will further increase the fishing pressure. In reaction to this, coastal communities will move inland, looking for farmland, which, in turn, will increase deforestation.

These changes also impact on species' behaviour during the summer and increase their vulnerability. Beyond a given threshold, these disturbances provoke a change in the ecosystem's equilibrium. Moreover, increased evaporation and extended dry seasons disturb the reproductive cycle of tortoises and decrease the viability of their nest.

Tourism sector

Sensitive areas are also disturbed by the rapid growth of the tourism sector in coastal regions, which increases pollution, sedimentation, and habitat destruction and fragmentation.

As mentioned earlier, the tourism sector is rapidly developing in the region. Its impact on the environment needs to be thoughtfully assessed to ensure the sector's sustainability and prevent damage to biodiversity. Impacts include both the direct impacts of tourist developments and related infrastructures and the indirect impacts of migration and increased population concentrations.

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[88] Refer to Box 6 and Box 7 for more background.
[89] Direction Générale de la Météorologie (2008).

The 'park-edge' effect

Threats affecting biodiversity within the landscape level, including within and around protected areas (PAs), also cause habitat loss, ecosystem fragmentation and ecological isolation that can be felt at the landscape at large. A known phenomenon in this context is the "park-edge effect", which seems to be affecting the integrity of both Mikea forests and Ranobé PA in the Atsimo Andrefana Region (see evidence in Figure 6 and Figure 7).

The degradation starts near the PA border and spreads including within the gazetted area. The triggers behind the park-edge effect include e.g. actual encroachment into PAs (i.e. establishment of farms and other PA incompatible land uses within gazetted areas), uncontrolled fires set by slash-and-burn farmers, which extend beyond the perimeter of PAs and illicit collection of resources from PAs (such as fire wood). In addition, upstream extraction of water for irrigation purposes is bound to have an impact on PAs located downstream.

Dune shifting

Dune shifting is one of the threats characteristic of the biodiversity of south-western Madagascar. Dunes shift as the regular trade winds from the West and the monsoon blow. These movements induce changes in the ecosystem profiles of the coast. Indeed, permanently shifting dunes have selective effects, i.e. only few species that are resistant to the sand mass are able to survive in their wake.

F) Key policy instruments and governance frameworks for environmental management in Madagascar

Frameworks for governing the extractive sector

In the 1990's the World Bank led an in depth revision of the Madagascar's mining and oil legislation, within the frame of liberalization policies that were launched across developing countries. As a result, a new Oil Code in 1996 (Law n°96-018), a Mining Code 1999 (Law n°99022) and regulations establishing a special regime for large scale mining project in 2002 (Law n° 2001-031 related to large scale mining investment – LLSMI, modified in 2005 by the Law n°2005-022) were adopted.[90]

With taxes on mining projects at 2%, Madagascar is one of the countries with the most attractive taxation system for investors. Regarding mining investment projects, those that are valued at more than 50 billion Ariary (about USD 22 millions), the LLSMI offers further incentives and advantages: taxing on company benefits is reduced to 25% (versus 35% as within the general system) or to 10% when products are processed in the country. In the latter case, taxes are established at 1% of the cost value of the product.

The National Board for Mining and Strategic Industries (NBMSI) is a public body that was created in 1976 to oversee mining and oil activities in the Island. The Mining Cadastre, was set up in 1999 and is the agency responsible for the overall management of the sector. The Mining Code is the milestone which enabled the rational development, to clarify rules and regulations, and expand mining activities not only for large scale projects by international companies but also for small scale national investors. The government does not expropriate neighbouring communities while according mining permits to companies, the State implements the rights to exploit mineral resources (dominion principle) under its charge, a principle which is recognized in almost all countries. In article 3 of the Code, the following reference is made: "*All surface areas, underground areas, water and deep sea areas of the national territory, containing mineral substances, are property of the State*".

The Mining Code has the objective of modernizing and simplifying the mining system, improve the management of mining permits, and mainstream environment measures within development projects. The Mining Code identifies the State as the main regulator of the sector under the dominion principle. The State has the rights to exploit all natural resources in the country. The principle of "first come, first served" is inscribed within the code. The revised Oil Code aims to create incentives for investors in Madagascar providing an "*an attractive legal mechanism*" for investors.

In conclusion, the main goals of the revised codes is to facilitate the granting of mining permits, offer companies fiscal, legal, and taxing benefits, secure investments and guarantee the free flow of capitals.[91]

Frameworks for governing the agricultural and tourism sectors

Following the *Detailed Program for Agriculture Development in Africa*[92], the three sub-sectors of agriculture, livestock and fisheries (ALF) have a defined common vision for 2025: "Madagascar in 2025, will have competitive and

[90] Les Amis de la Terre France. Synthèse (2012). Madagascar: nouvel eldorado des compagnies minières et pétrolières.
[91] Country Environmental Analysis, CEA, World Bank, 2013.
[92] From French translation *Programme Detaillé de Developpement de l'Agriculture en Afrique.*

sustainable agricultural production, including modernized agriculture industrial units to ensure food security and reinforce its exports to international markets". The Sector Plan Agriculture, Livestock and Fisheries (SPALF), designed to implement these guidelines, has stated "the extension of Agricultural areas, improved productivity and contribute to food security" among the objectives.

In addition, the Ministry of Tourism of Madagascar, who is responsible for developing this sector and implementing tourism policies has a Tourism Master Plan Outline and a National Committee for Tourism Development (NCTD). The latter is an interdepartmental committee aiming to achieve consensus among sector ministries and the support of all sectors in the strategic decisions of the tourism industry.

Other legal, policy and institutional frameworks for managing the environment

The legal framework for environment management in Madagascar is composed of the laws and regulations listed in the table below:

Table 13: Legal framework

Topic	Description
General legal instruments	Madagascar Constitution of the Fourth Republic, December 11th 2010; Law 90-003, Environment Charter, updated in 2015; Ordonnance 82-029 concerning the conservation and protection of national assets; Inter-ministry regulation 4355/97, regarding ecologically vulnerable areas and defining their boundaries, completed by decree n° 18/732, September 27th, 2004, which states the definition and demarcation of vulnerable forest vulnerable; Inter-ministry regulation 52005/2010, revising the inter-ministry rule 18633/2008 referred to the temporary protection of sites that have been identified by the ordonnance 17914/2006 and ending the suspension of mining and forestry exploitation in targeted sites (which expired in May 2015)
Protected Areas	COAP (Protected Areas Code), refers to PA management, originally defining management regulations for PAs under IUCN categories I, II and IV. In 2005, the COAP was revised and a new decree was developed, to enable the extension of PA estate, by including new IUCN categories III, V and VI, under the COAP. The Law n°2015-005, which contained the revision of the COAP was only recently endorsed by the government in 2015. It supersedes the COAP. This new law fills the gap in the former legal framework. It defines multiple land-uses within PAs such as those under UICN V and VI, and clarifies the role and responsibilities of local community's and the private sector, and those of the other stakeholders, in managing PAs clear. This law, mentions the role that PAs play in sustainable development of the landscape. It outlines the management arrangement for existing PAs. However, the revised COAP law does not yet have an approved regulating decree to make it operational. Excerpts and definition contained within the revised COAP: [...] Community Protected Area is defined as: a *Protected Area set up and managed voluntarily by local communities* in view of conserving and using natural resources sustainably, preserving customs and cultural patrimony and spiritual heritage associated uniquely with traditional sustainable resource uses. [...] Protected Area Manager: all public or private entities, associations, legally founded or *local communities holding Protected Area management responsibility* in collaboration with relevant stakeholders. [...] [...] the present law creates the Madagascar Protected Areas System, an overall and coherent structure which encompasses all Protected Areas, without exception, including privately owned Protected Areas, Community Protected Areas, and the future established Marine Protected Areas. [...] It introduces a new status of PAs, by incorporating new IUCN categories, with specific management purposes such as Natural Monument, Protected Harmonious Landscape and Natural Resources Reserve. The latter two categories integrate production activities within PAs while still containing complementary management rules. *It is through these means that new categories of PAs (New Protected Areas) intend to be the response to the need to conciliate biodiversity conservation and sustainable development within and in the buffers areas of PAs* [...]

Topic	Description
Community Management of Natural resources	GELOSE: Through the decentralization policies implemented in 90s, different mechanisms were instated to devolve management authority to local communities over natural resources. The process is called : "*natural resources management transfer*"(NRMT/TGRN) or commonly "*management transfer*" (MT/TDG)[93]; The TDG process is principally based on the GELOSE law and the Forest Management Contracts (FMC contracts). The GELOSE became legally operational in 1996[94], with subsequent revisions being made throughout the years. The GELOSE law refers to renewable natural resources. Agreements are signed between the local government and local communities to make the contracts official and to ensure simultaneously (1) transfer of Government responsibilities to local communities regarding the management of renewable natural resources, providing communities with the exclusive benefits that are derived, and (2) *relative* land tenure security for all land users (as opposed to *absolute* land tenure security, provided through a land tenure certificate issued by the land registry services); At the community level, local Community Based Organization (CBO) are created and representatives are elected to manage the contracts Forest Management Contracts (CFM)[95] are also contractual agreements. They legislate specifically on Government owned natural resources. In practice, they are less complex to implement than the GELOSE. The FMC is an agreement between the forest administration and the local community. It doesn't require relative land tenure security. Under the FMC, communities define spatially "*vital areas*" to inhabit, and areas strictly allocated to conservation, sustainable hunting and to exploitation for agricultural needs[96]. DECREE n° 2013-785 regulates the delegation by the Government for forest management to public or private parties.
Customary and Social norms	*DINA:* This norm originates from social tradition and governs local community functioning. Its content is endorsed by traditional authorities (e.g. *Raiamandreny*), and applied by local communities within the *fokontany*. It regulates natural resource uses and social, economic and land management. To be operational community TDG, within the framework of the GELOSE, communities adopt the *Dina*, which should contain norms regarding the sustainable use of natural resources by communities. *Dinas* are endorsed by the decentralized authorities of the Government and municipal courts and acquire legal enforcement value.
Environmental Assessment	The MECIE decree (Mise en compatibilité des investissements avec l'environnement) which regulates the compatibility of productive and infrastructure investments with the environment sets the legal framework to apply the Environment Impact Assessment (EIA) regulation. It defines the procedures required for investors to obtain environmental permits, before starting their project. The National Environment Board (NEB) is the agency designated to provide support and coordinate the assessment of projects and their compliance with regulations, and issuing the environmental authorization/permits to investors once the EIA's are approved and the process is concluded. The assessments and monitoring of the EIA's and the environmental mitigation measures it may contain, are conducted by the Regional authorities, through a committee set up for this purpose (*Comité Techniques d'Evaluations et Comité Technique de Suivi).* All sector ministries relevant to the investment, have a seat in the committee. The NEB facilitates this process in support to the Region.
Mining and Oil	Mining and Oil Codes[97] : the guidelines of the National Board for Mining and Strategic Industry (NBMSI/ OMNIS) are included in both codes, that state that all mining and oil activities have to fit within the NEP and promote social and ecological balance, in accordance with MECIE and the EIA regulations: For oil activities: all exploration studies such as terrestrial and marine seismic exploration and drilling, exploration assessments for fuel and oil production, and oil and rough materials transportation. For mining activities: all assessments/studies conducted within the framework of the exploration permits, those inscribed within the exploitation permits, and those concerning both types of permits.

[93] From the French translation "*transfert de gestion des ressources naturelles*" (TGRN) and more simply "*transfert de gestion*" (TDG).
[94] Law 96-025 of September, 30th 1996, Decrees 2000-027 and 2000-028.
[95] Decree n° 2001-122 stating implementation conditions of CFM.
[96] More practical than GELOSE, CFM is an agreement between forest administration and the community. It does not require land tenure security from resource users, not even partial security.
[97] National Board for Mining and Strategic Industries website (2015).